THE AEROPLANE and ASTRONAUTICS

JANUARY 1, 1960

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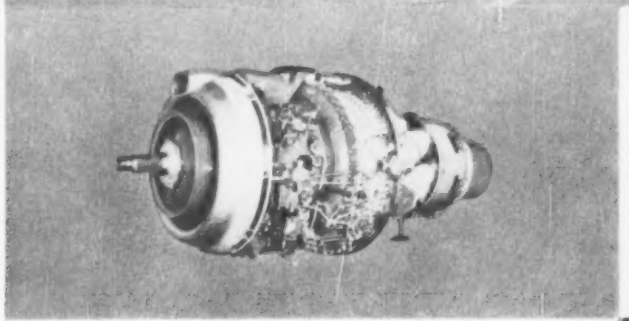

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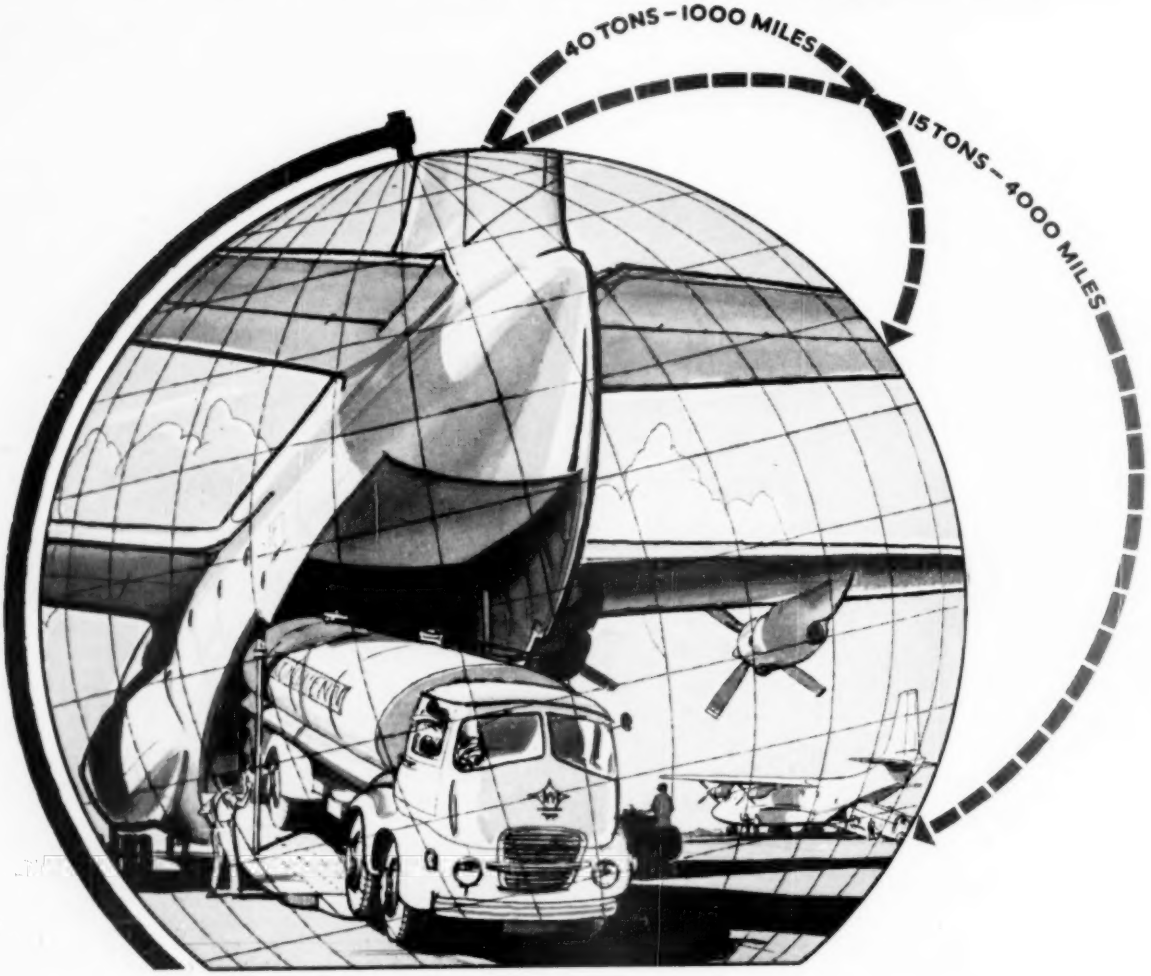

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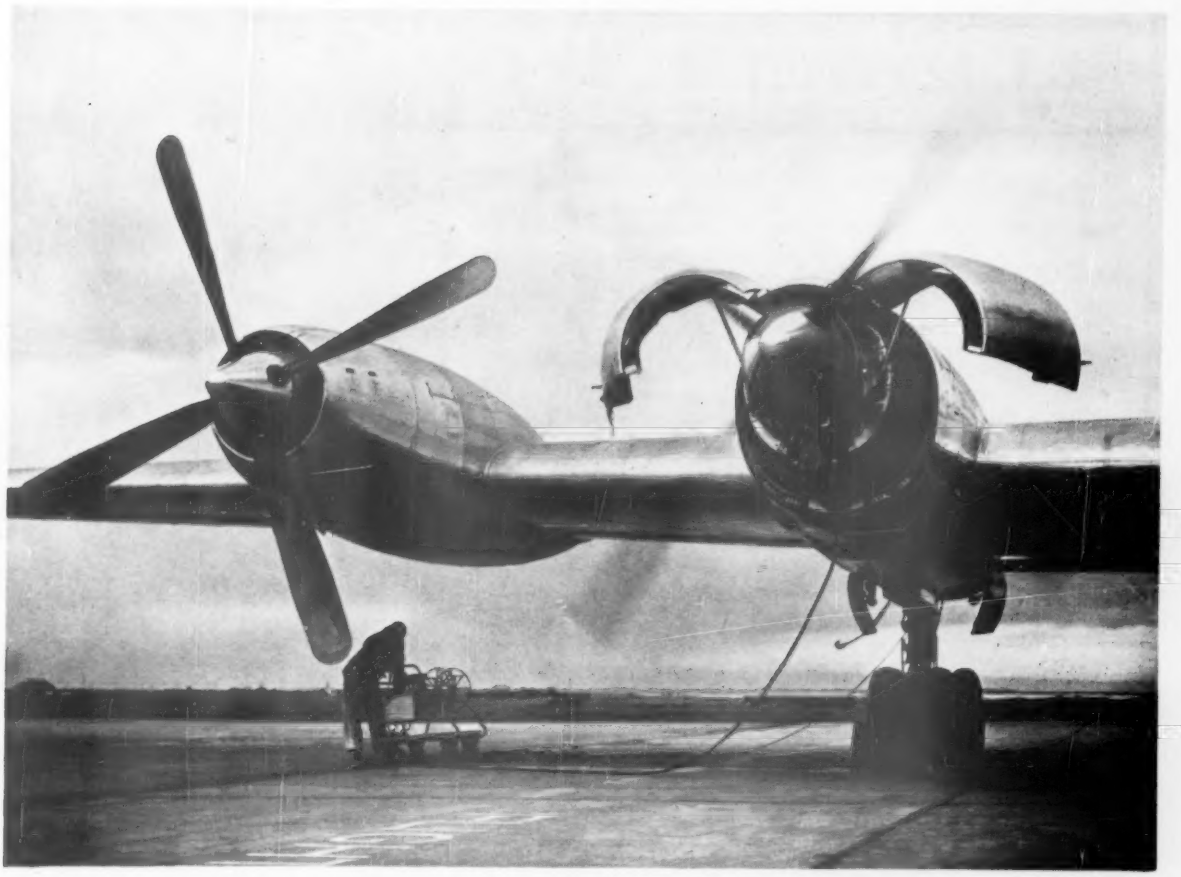

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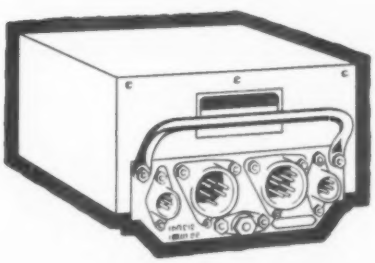

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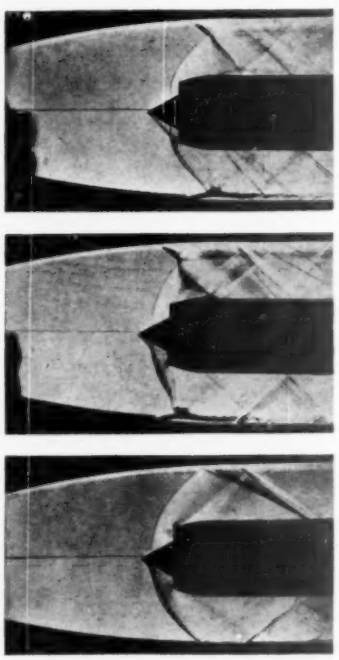

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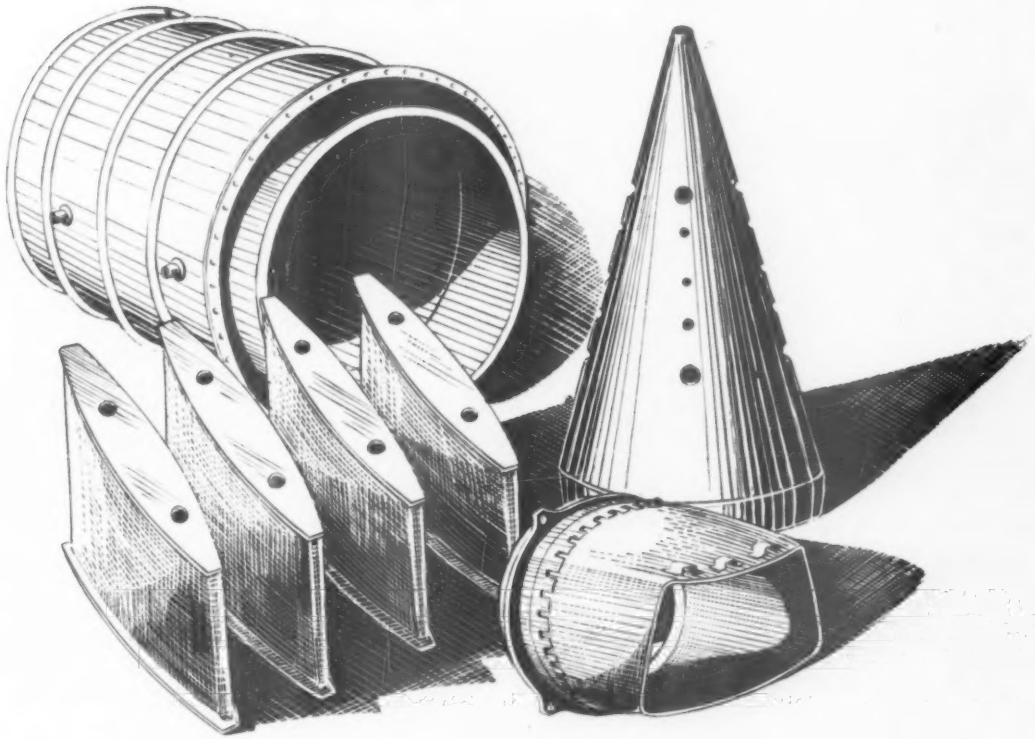

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THE AEROPLANE and ASTRONAUTICS

VOLUME 98 NUMBER 2515 JANUARY 1, 1960

The Year's Events

It is customary at this time of year to review, in one way or another, the events of the past 12 months. Some of the highlights of a year that was full of highlights are shown pictorially elsewhere in this issue; here we propose to review 1959 in rather more general terms.

One of our friends on the other side of the Atlantic has said, in a letter of Christmas greeting, that the 12 months that have now passed had been hectic and exciting at times and drab, disappointing and frustrating at others. How well these adjectives can find a place among the aeronautical events of 1959. And such is the very nature of progress that, in the New Year that is stretching before us, much the same comments will doubtless apply.

Pride of place for excitement must go to Russia's successful attempts to free a man-made object from the Earth's gravitational field —first with a near-miss of the Moon by Lunik I which went into solar orbit; later with a lunar impact by Lunik II; and, more recently, by the remarkable photography of the Moon's hidden face. This alone has given 1959 an outstanding place in history.

If anything was hectic during the year that is past, it was the rapid events of the *Daily Mail* London-Paris race. Those energetic demonstrations of how to reduce the elapsed journey-time for travellers between the centres of these two great cities provided much food for thought and a noteworthy variety of solutions.

For drabness there was the inevitable ration of ministerial pronouncements, with monotonous emphasis on economy and a shrinking aircraft industry.

Disappointments there certainly were. Among the sharpest for many people in this country was the Supersonic Transport Aircraft Committee's recommendations of Mach 1.8 as the target for a British supersonic airliner instead of the more inspired Mach 3 that is most likely to be chosen by America. And another committee, dealing with scientific policy, could well claim the distinction of producing the most frustration by an unimaginative assessment of the part Great Britain should play in space research.

It is to be hoped that the aeronautical events and developments of 1960 will, in the main, prove to be even more stimulating and progressive than the principal ones of 1959. And we wish all our readers at home and throughout the World a prosperous New Year.

An Occasion to Note

One important event planned for this year, which seems a likely contender for a prominent place among the more noteworthy occasions, is the Anniversary Luncheon organized by the Royal Aeronautical Society to be held on January 12 at the Dorchester. It is intended to serve the dual function of a celebration of the 94th birthday of the oldest aeronautical society in the World and commemoration of the Golden Jubilee of what has come to be considered as the Golden Year of British Aviation—1910.

This occasion certainly seems likely to start the aviation calendar for 1960 with something to remember. It was originally planned that the Prime Minister would be the guest of honour and principal speaker, but unfortunately his forthcoming South African tour has now made this impossible. Fittingly enough, however, his place will be taken by the Minister of Aviation, Mr. Duncan Sandys. Doubtless, he will say something about recent major moves in the reshaping of the aircraft industry and will indicate what other like changes may be expected in the not-too-distant future.

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Matters of Moment

Anglo-German Collaboration

IT would seem highly likely that a technical agreement covering VTOL aircraft development has been, or is soon to be, drawn up between Short Bros. and Harland, Ltd., of Belfast and the German Messerschmitt company. There has been neither confirmation nor denial of this by Shorts; however, Messerschmitt executives have been to Belfast and Short directors have recently visited Germany.

With such an agreement it is possible that the supersonic VTOL fighter reported to be under development by Messerschmitt may be to some extent a joint venture with Shorts. This might explain the recent statement by the Minister of Defence, Mr. Watkinson, when he disclosed that Britain might adopt and build a German VTOL aircraft.

Mr. Watkinson said two British companies were already competing in this field. They are presumably Shorts and Hawkers, whose respective solutions to the VTOL problem are backed by our two largest engine companies, Rolls-Royce and Bristol Siddeley. For small military VTOL aircraft Rolls-Royce favour the use of jet-lift engines such as their RB.108; Bristol Siddeley advocate combining the lift and thrust functions in a single engine such as the BE.53 ducted fan.

Thunderbird's Successor

ACCORDING to the English Electric company's annual review of its activities, development of a successor to the Thunderbird surface-to-air missile "is well under way." This new weapon system will make use of the most advanced radar techniques and will have increased range and improved performance against very low level targets.

The review also expresses satisfaction at the success of the Service acceptance trials of Thunderbird itself. These trials, conducted jointly by the M.o.S. (now M.o.A.) and a Service trials unit at Woomera have, it says, proved the missile to be exceptionally reliable. It adds that these results have been achieved by units from the first run of production missiles.

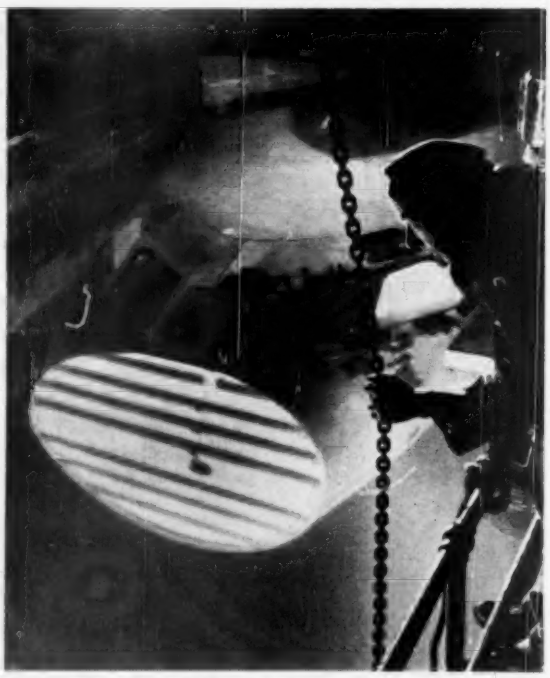
A feature of the company's activity during 1959 has been a continued shift of emphasis from manned military aircraft to guided weapons and to civil aviation. So far as the latter is concerned, mention is made in the review of important contracts received for English Electric equipment for civil aircraft. The importance placed by the company on this work was, in fact, underlined during the year by the opening of a special service and stores depot at London Airport, so that the company's aviation equipment could be dispatched rapidly to any part of the World.

Among the developments in this particular field has been a 9-kW. brushless DC generator to meet the requirements of medium-range civil aircraft. Air-cooled generators have not proved practical for high-speed aircraft of the type coming into use and development tests are being done on an oil-cooled brushless AC generator for such aircraft.

On the aircraft side during the year, the review says, the final stages of the Lightning's flight test programme designed to clear the aircraft—with its armament and navigation systems—for service with the R.A.F., have been accomplished. Production of the Lightning is said to have been "in full swing" throughout the year and a considerable number of these aircraft are now flying.

Mention is made in the review of the formation at the beginning of the year of English Electric Aviation, Ltd.—a wholly owned subsidiary to be responsible for the research, design and development of aircraft and guided weapons. Something is said, too, about the joint design study with Vickers-Armstrongs (Aircraft) for the TSR2 supersonic strike "Canberra-replacement" aircraft, and the subsequent development contract received by the two companies; no information is forthcoming, however, about progress made to date or of further details of this important aircraft.

SHAPE TO COME?—First photograph of a model of the remarkable Swallow variable-geometry aircraft designed by Dr. Barnes Wallis. Here the wing tips are moved forward for low-speed flight; at high speeds they swing back to form a sharp arrow planform.



TESTING THE D.H.121.—The first large component of the Airco D.H.121, a fuselage nose section and cockpit canopy, is now undergoing static and fatigue pressure testing at Hatfield. A proof pressure test has been completed at 11 p.s.i. and a fatigue test representing 40,000 flights of 1½ hr. each has now begun.

Fighter Replacement Round-up

WITH one Commonwealth and at least three NATO countries interested in replacing or building up their respective fighter forces, the business of selling such aircraft has recently reached new levels of international competition.

One of the most significant developments during the past few weeks has been the West German plan to acquire a further 364 Lockheed F-104G Starfighters for the West German Air Force. This new purchase is in addition to the 96 Starfighters already ordered by Germany direct from Burbank and the 200 Starfighters to be built under licence. Some of the additional 364 fighters are also expected to be built in Germany under licence and components for the Burbank-built Starfighters are being manufactured by Canadair in Montreal.

This latest German purchase, which brings its total Starfighter order to 660, means that in approximately six years the West German Air Force fighter-bomber force will comprise only Starfighters and Fiat G.91s. These will replace the Sabres and F-84 Thunderstreaks at present in service.

The Netherlands and Belgian Air Forces are also looking for a replacement for their 350-odd Hunter F.4s and 6s, and

a joint decision on their selection is expected in the very near future. Both countries want to build their new fighters under licence as a combined venture and the likely choice seems to be between the Starfighter, the Dassault Mirage 3A and the Republic F-105D Thunderchief.

This last-named type is reported to have been offered to the Royal Netherlands Air Force at a guaranteed fixed price of $1.4 million per aircraft and it is thought that the French have made an offer which will enable Dutch and Belgian manufacturers to build Mirage 3As at a cost reported to be £75,400 per fighter less than the undisclosed Starfighter price. The most likely contender would seem to be the Starfighter, which could obviously be built in Germany as well as in the United States, although Lockheed has offered Holland and Belgium manufacturing rights.

As mentioned in our issue for December 18, the Australian Government is studying a number of fighters to replace the R.A.A.F.'s Commonwealth CA-27 Sabres and a team from the Service's London headquarters has started an evaluation of the Mirage 3 as a possible aircraft. Australian technicians have visited the Dassault works and representatives of the French company have been to Australia for talks with the Minister for Air and the R.A.A.F. Air Board.

A Sting for the Frigates

ALL-WEATHER night and day operations against submarines by frigates and helicopters acting together as hunter/killer teams came a stage nearer reality a fortnight ago when a successful series of night landings was made on the frigate H.M.S. "Undaunted" by a Saunders-Roe Wasp helicopter. This represents one of the first occasions on which a helicopter has been operated by night from a landing platform on a frigate; during these trials, made by three pilots, the Wasp made 31 night landings.

Different lighting systems were evaluated; in one case landings were made by the light of a searchlight mounted on the helicopter and in another the position of the platform was outlined by small lights. The trials lasted five weeks and during that time more than 300 landings were made on the 21-ft. x 26-ft. platform. Details of the Saro Wasp helicopter and photographs of frigate trials are given in an article on pages 13 to 16 of this issue.

Frigates are ineffective against fast, modern submarines, either nuclear or conventional, which can travel faster submerged than the frigate can move on the surface. But if the frigate's sonar detection system is used to direct a helicopter carrying homing torpedoes, the chances of effective anti-submarine operations are much greater. With light all-weather helicopters, such as the Wasp carrying homing torpedoes, now becoming available, the frigate may regain the importance which it held in the late War as an anti-submarine weapon.

Aerodynamics Made Easy

THE introduction of a new instructional film in the series produced by the Shell Film Unit is always something of an event because their educational value is so unfailingly high. Last week came the première of the third in the series of simplified explanations of the aerodynamics of high-speed flight. The first, produced in 1956, dealt with the approach to the speed of sound; the second came a year later covering transonic flight; and now, to complete this particular trio, Part 3 takes one into the realm beyond the speed of sound.

In colour and again with a most skilful application of animated diagrams, this little film gives a clear introduction to such problems as the need for sweepback and the choice of double-wedge or circular-arc aerofoil sections. It contains, incidentally, one of the best illustrations of Mach angle and the formation of a Mach cone that we have seen to date. The diagrams, which are never dull because they are so well devised, are interspersed with some very fine air-to-air, and other, shots of a variety of French, American and British supersonic aircraft. And to round off the performance on a futuristic note, adding point to the technicalities, the film ends with some views of a number of hypothetical next-generation supersonic aircraft.

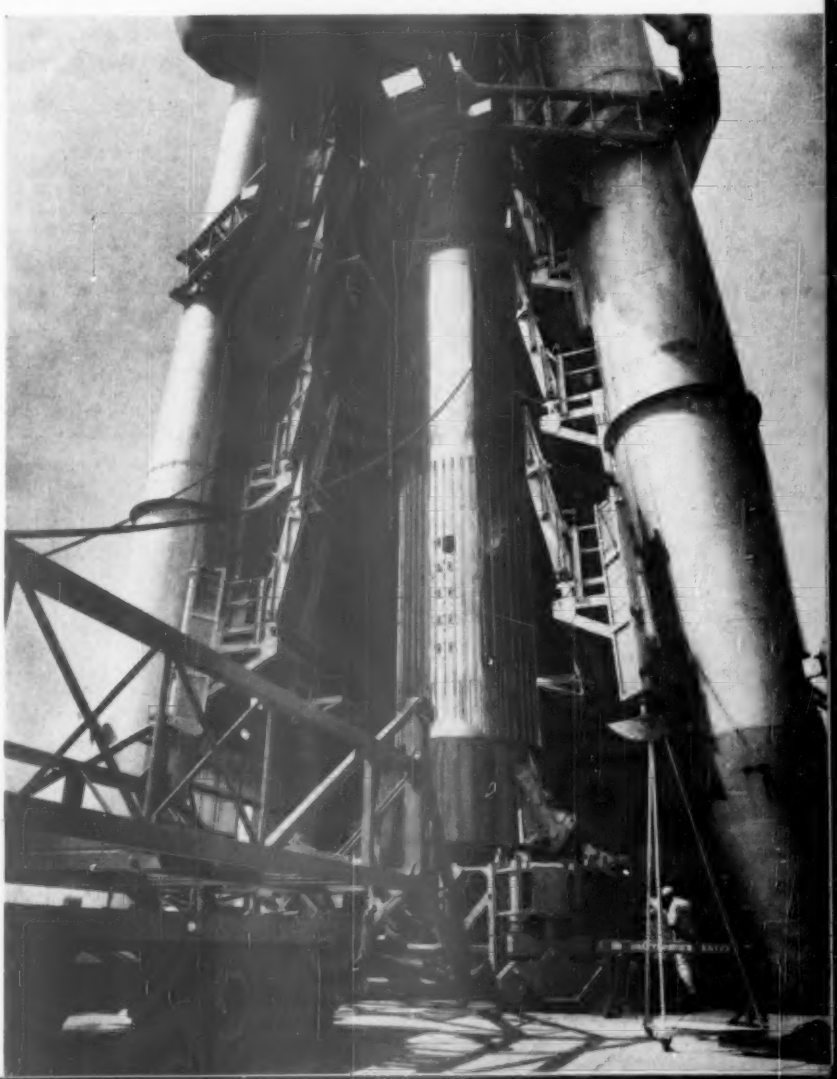
Showing the Hunter Trainer

ANOTHER aviation film première last week was that of "The Hunter Jet Trainer," a small documentary produced for Hawker Aircraft to aid their sales drive by showing prospective customers something of what the aircraft can do. This it achieves with some first-class photography from the ground and in the air. Some particularly effective shots have been taken with a camera mounted in the tip of the fin.

It would be pointless to try and describe the film in detail—in the space of 20-odd minutes it presents a mass of information in a most acceptable form and in colour.

After a suitably impressive introduction by the black Hunters of No. 111 Squadron, the film takes the audience through a training sequence in which the pupil and instructor take-off and climb the Hunter Trainer to 40,000 ft. for stalls and a four-turn spin. Next, animated diagrams are made good use of for showing the almost unbelievably wide range of stores that can be carried by the two-seater. These are followed by sequences giving practical demonstration of the firing of the Aden gun, two-inch rocket pods, and napalm bombs. Other splendid air-to-air shots include some exhilarating low flying at high speed and air-to-air gunnery practice.

The company has high hopes for the two-seat version of its ubiquitous Hunter—versions of which have been exported to the tune of £200m. to date. Estimates have indicated that over the next five to 10 years somewhere around 5,000 advanced trainers in the World's air forces will be scheduled for replacement. The Hunter Trainer should stand a good chance of taking a useful share of this market. Already it has been adopted by Denmark, Holland, Peru, Jordan and India as well as by the R.A.F. and the Royal Navy.



FOR LAUNCHING SOON.—This year's "big event" in the field of British rocketry is likely to be the launching, at Woomera, of the de Havilland Propellers Blue Streak LRBM. Blue Streak offers great promise, not only as a ballistic weapon but for boosting satellites into orbit.

General Aviation News

FIRE-FIGHTING MARS.—The four surviving Martin Mars flying-boats of six built for the U.S. Navy in 1947 are to be converted by Fairey Aviation of Canada as fire-fighting tankers. They have been purchased by Forest Industries Flying Tankers, Ltd., and will be used in British Columbia to combat forest fires. Each Mars will carry 7,000 gallons of water, which can be released in four seconds from 200 ft., to cover an acre of forest. Refilling the water tanks will take one minute.

SINHALESE PROVOSTS. — Six Hunting Provost T.Mk.51s have been handed over to the Royal Ceylon Air Force. At a recent brief ceremony a Hunting test pilot, Lieut. Cdr. J. Overbury, handed the aircraft's log books to the C.-in-C., Air Cdre. J. L. Barker. Armed versions of the Mk. 3 trainer, the T.Mk.51s will be employed on Army tactical support and reconnaissance work in addition to pilot training.

PROBE POSTPONED. — A U.S. attempt to launch a solar probe between the orbits of Earth and Venus, originally scheduled for December 10, has been postponed because of "electronic difficulties in the probe." A new firing date may be announced this month.

VANGUARD SILENT.—The tracking and telemetry transmitters within the Vanguard III satellite became silent in mid-December. Launched on September 18, the satellite broadcast scientific data over a period of 85 days; the silver zinc batteries it carries had a nominal lifetime of 90 days. It is expected to remain in orbit up to 40 years.

EXPORT POWER.—A contract has been signed by the Japanese Defence Agency for 32 Bristol Siddeley Orpheus turbojets for the Fuji T1F2 trainer. This aircraft was described in our issue of March 6, 1959.

SIKORSKY S-64.—Sikorsky Aircraft plans to fly a prototype of its S-64 turbine-powered crane in the autumn of 1960. Similar in layout to the S-60 already flying, it will have two shaft-drive turbine engines and a payload of eight tons. A family of Sikorsky "turbo-cranes" is under development to lift payloads up to 40 tons.

RECORD REWARDS.—For setting (subject to F.A.I. confirmation) new World records for altitude, speed, speed over 100-km. circuit, and helicopter altitude, five U.S.A.F. pilots have each been awarded the American D.F.C. Major J. Rogers, who set the absolute speed at 1,520.9 m.p.h. in an F-106, was awarded the Thompson Trophy; Brig. Gen. J. H. Moore won the Bendix Trophy for his 1,216.48 m.p.h. over 100 km. in an F-105, and Capt. J. B. Jordan gained the General Electric Trophy for reaching 103,395 ft. in an F-104.

Commercial Aviation Affairs

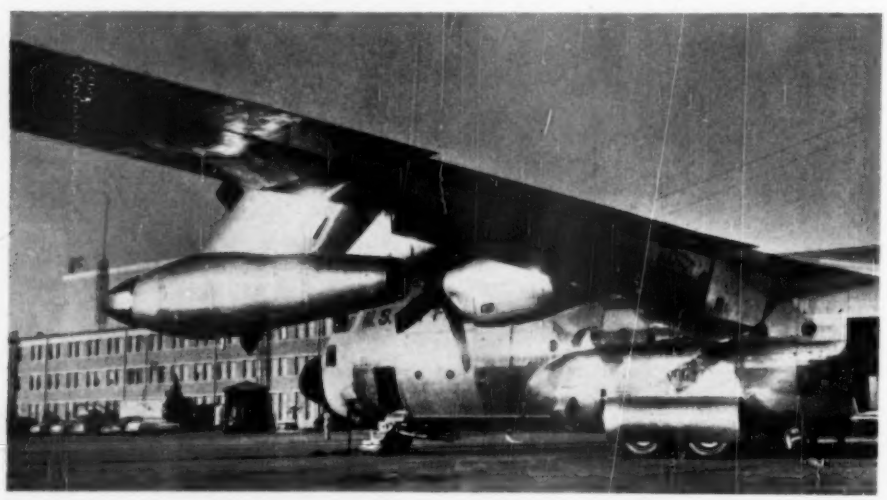
VANGUARD NOTE.—Five Vickers Vanguards are now flying and the tropical trials at Khartoum and Johannesburg have been completed. The fifth aircraft (G-APED) will start five weeks' intensive route proving trials early this year and will be seen at nearly all European and Eastern Mediterranean airports.

SABENA CARAVELLES.—The four Caravelle VIs ordered by Sabena for delivery in February, 1961 (see our Dec. 18 issue), will have 70 seats in first-class and tourist cabins. They will be used on the Sabena network in Europe and to the Middle East; typical journey times from Brussels, as given by Sud-Aviation, will be Frankfurt, 45 min.; Nice, 1 hr. 36 min.; Rome, 1 hr. 50 min.; Palma, 2 hr. 5 min.; and Ankara (with stops at Frankfurt and Athens), 4 hr. 15 min.

VISCOUNT 409.—Vickers-Armstrongs (Aircraft) has confirmed the sale of a fourth Viscount 807 to N.Z.N.A.C., for delivery in 1961. The total of Viscount sales is now 409.

BRITANNIA DELIVERY.—The two Bristol Britannia 308s for Transcontinental S.A. left Bristol for Buenos Aires on December 16 and 17 respectively. They have been furnished to carry 16 first-class and 88 tourist passengers and are now in service between B.A. and New York via Sao Paulo, Rio and Caracas.

VARIG CARAVELLES.—Varig (Brazil) planned to inaugurate Caravelle service on December 21 from New York to Nassau, Port of Spain, Belem, Rio de Janeiro, Sao Paulo, Montevideo and Buenos Aires. An initial weekly service will be increased to two a week early in 1960. The Caravelles will be maintained by Lockheed Aircraft Service at New York.



STOL HERCULES.—Blown flaps and control surfaces are being tested on a Lockheed Hercules transport. Compressed air is supplied by two Allison YT56-A-6 "load compressor" engines in wing pods.

REDUCING THE PENALTY.—The provisional increase of 7% rotation (nosewheel-lifting) speed for the Boeing 707 Intercontinental, imposed by F.A.A. last September (see our issue of October 9, p. 307), has now been finalized at 3-5% above the originally certificated speed. This reduction in V_R permits higher gross weights to be used when there are runway-length limitations—as, for instance, at L.A.P., where the longest, 9,576 ft., runway is insufficient for maximum weight take-offs.

DEADLOCK.—Discussions to renew the air services agreement between France and Australia have reached a deadlock, and air traffic rights between the territories of the two nations were to be suspended on December 31. Qantas provides a fortnightly service between Sydney and New Caledonia, and T.A.I. calls once a week at Brisbane on its Paris-Borabora service. Australia has asked for a trans-Pacific route via Tahiti in return for T.A.I. traffic rights at Sydney.

MORE WAITING ROOM.—Alterations are to be made in the passenger terminal building at London Airport to provide more room for airline check-in desks and passenger departure lounges, and less room for Customs examination. Final details of the changes are still to be approved by the M.o.A.

HERALD BACK. — The prototype Handley Page Herald (G-AODF) arrived back in the U.K. on December 18 at the end of its Australian tour. This aircraft has now visited 41 countries in the course of three demonstration tours starting in April, 1959, and has covered 135,000 miles and made 400 landings.

APPROVAL.—Members of the Federal German Government's approval board inspecting the Martin-Baker GU5 ejector seat in the Lockheed T-33. Martin-Baker seats are to be fitted to all the Luftwaffe's American jet aircraft.

VISCOUNT LOST. — An Alitalia Viscount on a training flight crashed at Ciampino, Rome, on December 21, killing the two occupants.

DOPPLER FOR T.C.A. — Collins Doppler FM-CW Radar Navigation Systems have been ordered by T.C.A. for its fleet of DC-8s.

KHARTOUM LIGHTS.—G.E.C. high-intensity runway lights have been installed on the northern approach and runway at Khartoum Airport, to improve visibility in the "haboob," a local rising sand storm. High-intensity angle-of-approach indicators have also been installed.

THE RIO TRAGEDY.—A VASP Viscount flying from Sao Paulo to Rio de Janeiro and a Brazilian military trainer collided over Rio on December 22. All 31 occupants of the Viscount were killed, and at least 10 other fatalities were caused by the falling wreckage. The pilot of the trainer, an air force cadet, parachuted to safety.

AIRPORT ACTIVITY.—Air transport movements at U.K. aerodromes in September increased by 6% to 41,229, and passengers handled increased by 20% to 1,039,682. Freight picked up and set down was up by 38% to 30,551.6 short tons.

M.E.A. RADAR.—Middle East Airlines is equipping its fleet of Viscounts with Ekco E160 weather radar and is installing the equipment.

SAFER SEATS. — Passenger seats designed by a Sabena technical engineer are being made by Sabena for the first-class cabins in its fleet of Boeing 707s, and also for the Air France Boeings. The seats have special features to increase comfort and safety.

News About People

RETIRING FROM DOUGLAS.—Frederic W. (Ted) Conant, vice-chairman of the board and senior vice-president, manufacturing, of the Douglas Aircraft Company, is to retire next February. He has been in charge of Douglas production since before World War II.

BEST CADET.—Senior Under Officer T. C. Porteous with the Sword of Honour which he received as the Best Cadet of Cranwell's No. 76 entry.

"JANE'S" OCCASION.—Mr. Peter Masefield with the retiring editor of *Jane's All The World's Aircraft*, Mr. Leonard Bridgman, on his left and the new editor, Mr. J. W. R. Taylor, on his right. Extreme right is Mr. H. Sampson. The occasion was "Jane's" Golden Jubilee party.

T.C.A. APPOINTMENT.—Mr. John A. Ross, station operations manager for T.C.A. at London Airport for 12 years, has been appointed assistant director of passenger services in Montreal.

A BRISTOL RETIREMENT.—Mr. C. M. Tunstall, assistant works manager, development manufacturing (aero), of Bristol Siddeley Engines, Ltd., retired on December 31. His association with the Bristol Siddeley organization dated back to 1916 when he first joined Siddeley Deasey, Ltd. (later known as Armstrong Siddeley Motors, Ltd.). He was appointed assistant works manager, development, of Bristol Aero-Engines, Ltd., in 1955.

B.O.A.C. CHANGES.—Mr. J. R. Allison has left Karachi to take up his new appointment as B.O.A.C. manager, Nassau. He is succeeded as manager for Pakistan and Afghanistan by Mr. B. D. Cayford, D.F.C.

Air Transport

The Calculated Risk

DURING the past 15 years the air transport industry has, on the whole, been astonishingly lucky. Very few of its new aircraft have run into trouble which was disastrous enough to make the regular or potential air traveller think again. And the industry has been especially lucky since the introduction of the big turbojets with their theoretically catastrophic potentialities.

Maybe the word "lucky" is the wrong one to use. The operators and manufacturers have taken a calculated risk and the difficult situations have, more often than not, been saved by the skill, experience and good training of the flight-deck crews. Certainly this has been true during the introductory period for the big turbojets—and was probably true during that of earlier new types, including the comparatively brief airline life of the first of the turbojets.

Major disasters with the 707 have been avoided on at least three (and probably more) occasions during the past year by good work on the flight deck. Even though one "incident," the dive over the Atlantic, was initially caused by inattention in that important section of the aircraft, the error was more than offset by the recovery effort—and one would not normally expect an aeroplane to enter a howling spiral dive just because of temporary inattention. The safe denouement for the other two known events—the Roman Holiday affair at Idlewild (when the aircraft was brought safely in with major undercarriage failure) and the accidental flaming-out of two engines just after take-off from Le Bourget—were directly to the credit of the crews.

The remarkable thing is that there have been no publicly recorded cases of real trouble during the actual take-off—though at least one has been marginal because of the effect of snow or slush on acceleration. Although the take-off performance is safe enough according to the book, there is, in fact, precious little paving left at lift-off and nobody really believes that it would be possible to make a safe stop from V1 speed when the remaining runway is already being eaten up at a rate of something over 200 ft./sec. and when allowance must be made for decision delay.

The situation in the take-off case has been saved—and will continue to be saved—by the essential reliability of the present-day turbine engine. One has only to realize that the rotation and lift-off speeds of the long-haul turbojet transport, even at a fairly moderate gross weight, are of the order of 155 and 165 knots to appreciate that, once decision speed has been reached, the aircraft is irrevocably committed to take-off. These speeds are better understood when they are converted to feet per second (260 and 278 respectively) and thought of in relation to available runway distance. In such circumstances absolute as opposed to statistical safety can be offered only by the construction of thousands of feet of stopway at the ends of all runways.

The facts remain that, to 1958, accidents had not increased in number and that between 1952 and 1958 the airline fatality rate per 100 million passenger-miles had shown a fairly steady decline from 1.56 to 1.13—though 1959 results will probably show an increase.

Nevertheless, it is very doubtful if aircraft are actually more reliable than they were, and it is likely that the steady state of the accident trend can be attributed largely to systems duplication and to better flight-crew training—in particular to the extensive use of simulators in the development of practised, confident, actions in emergency and in the correct sequencing of flight and systems procedures.

My own personal statistics, for what they are worth, suggest that aircraft are much less reliable than they were 15 to 20 years ago. In the course of some 1,800 hours of War-time ferrying and routine production and other testing I suffered two complete engine failures and (not including the frightening results of minor ground-crew errors, such as the failure to attach such things as panels and cowlings correctly) eight other grossly displeasing situations caused by systems, control, or ancillary failures. During about 500 hours of passenger flying in transport aeroplanes since the War I have been involved in unrehearsed emergencies following two complete engine failures and two systems or ancillary failures. So we have 180 flying hours per serious incident for War-time flying (in quickly produced and sometimes haphazardly modified aircraft) against 125 hours per incident in post-War transport aircraft.

Thanks to flight-deck skill and experience the four post-War events resulted in nothing worse for me than frights and periods of nervous discomfort while the situation was being effectively dealt with by the crews of the aeroplanes concerned—but any one of the four *might* have ended less satisfactorily. We are now entering an air transport era in which aeroplanes are becoming very complicated and in which the price of any human failure to cope with emergencies is higher than it has ever been.

The very least that can be done is to ensure that it is comparatively easy for the flight-deck crew to deal with emergencies as they inevitably arise—and to do more than has been done to ensure that these emergencies are as rare as they can possibly be made by technical experience and adequate proving.

In the current issue of *The Log* an airline pilot points out, amongst other things, some of the prospectively dangerous peculiarities of the flight-deck equipment of a comparatively new transport aeroplane—which, he emphasizes, is otherwise exceptionally safe and pleasant to handle. ". . . The fuel heater switches," he writes, "are labelled 'open' and 'shut' (your guess). . . . To lower the undercarriage on the red system the emergency lever is moved not down, but up. . . . On the blue system a blue light may show failure, but on the yellow system a yellow light shows satisfactory operation. . . . The control column effectively prevents the pilots from seeing their respective turn-and-bank indicators. . . . The optical properties of the centre windshields are frightening . . ." and so on.

The writer concludes with the following pointed comments:

"1. If there is a system which works perfectly on another aircraft, use it—don't bother to design a new inferior system.

"2. The normal car driver does not think about such things as when to change gear; he does it by habit and his subconscious. Much piloting is the same. So don't change conventions unless the cost of the training, which will unlearn the old habits as well as teaching the new, is more than justified.

"3. Let controls work in the natural sense and keep instruments unambiguous. Remember that pilots have eyes in their heads, not their knees, and place instruments accordingly.

"4. Keep systems as simple as possible and able to revert to basic if necessary.

"5. Leave room on the flight deck for the pilot (always assuming the aircraft needs one)."—H.A.T.

TREE TRANSPORT—This Antonov An-10A, making a refuelling stop at Prestwick on December 17, was the first of the type seen in Britain. It was bound for Andrews Air Force Base, Washington, from Russia, with a gift of 40 trees and shrubs for President Eisenhower's Gettysburg farm from Mr. Khruschev.

Fourth Airport for New York

BY 1965 the three airports already serving New York are likely to reach saturation point, with traffic at almost twice the 1958 volume, according to the latest surveys of the Port of New York Authority. Development of a fourth major airport in the New Jersey-New York Metropolitan Area has now been proposed to meet the continuing traffic growth, which by 1975 is expected to be more than three times the 1958 figure. The new airport would be designed to handle transcontinental flights, but not international traffic.

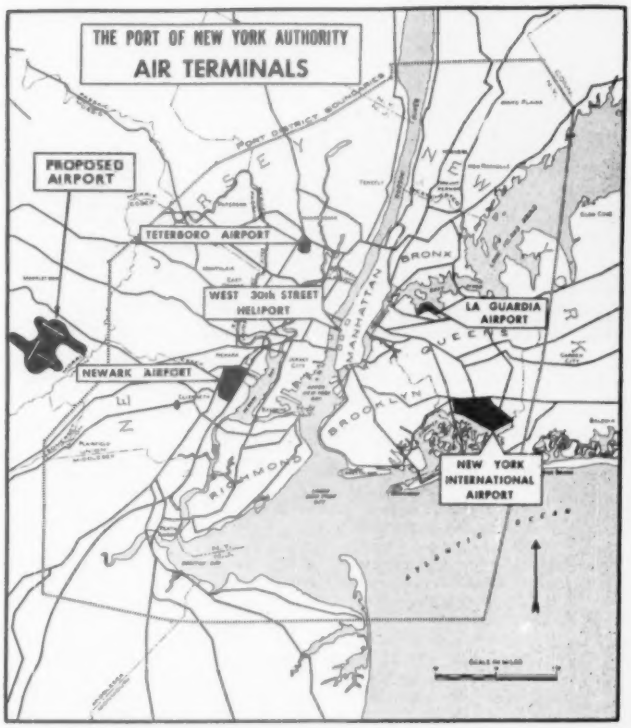
After studying 15 sites in New Jersey west of the Hudson River, the Authority has found only one which meets all its requirements. This is in Morris County, south of Morristown and approximately 30 miles from Manhattan. A large part of the proposed site is known as the Great Swamp and would require a special drainage scheme to control flooding. A village and several large estates are included in the 10,000-acre site.

The proposed layout provides four runways of at least 12,000 ft. each, in parallel pairs not less than 3,000 ft. apart and integrated with the alignment of the runways at Newark, La Guardia and New York International. Thus, the two instrument runways would be on the 4/22 alignment (northeast-southwest) and two others at right angles, on 13/31. To reduce the noise for local communities, the runways would be so sited that the start of the take-off roll would be at least five miles from the nearest community. Cost of construction would be about $220 million and the airport—like the others provided by the Port of New York Authority—would be self-supporting.

The growth forecasts which have led to the Authority's proposals indicate that peak-hour movements in the New Jersey-New York area in 1965 will be 169, compared with the maximum of 150 which can be handled at Idlewild (70) and La Guardia and Newark (40 each). By 1975, over 200 movements per peak hour are expected. Capacity for at least 70 movements per peak hour is required at the proposed new airport, which in turn dictates at least four runways.

The Authority notes that about a quarter of all the U.S. commercial air travellers use one of the New Jersey-New York airports. From 4.3 million in 1949 the total increased to 13.5 million in 1958 and is expected to reach 24.7 million in 1965 and 45.3 million in 1975.

Major legal battles are forecast in New York before permission is obtained for the airport to be developed, with local communities and citizens resisting the plan. The project will be submitted in 1961 to the New York and New Jersey Legislatures, both of which must approve it before work can proceed. Completion is not expected before 1970.



Flight Deck Requirements

NEW measures by the Federal Aviation Agency to regulate the age and training of U.S. airline pilots (as recorded in our issue for December 18) have clearly been influenced by the introduction of jet equipment. Both the age limit for pilots and the rules concerning airline training programmes are intended, says the F.A.A., to provide "a greater measure of safety for the flying public."

Explaining the mandatory retirement age of 60 for airline pilots, the F.A.A. refers to "the progressive deterioration of both physiological and psychological functions which normally occur with age" and result in significant medical defects. "Allowing pilots in this age group to remain in command of aircraft carrying up to 165 passengers at speeds of 550 m.p.h. would be a hazard to safety in air carrier operations." The regulation is based on the fact that sudden incapacitation through heart attacks and strokes becomes "significantly more frequent in any age group reaching 60" and cannot be predicted by prior medical examination.

The F.A.A. admits that age has never been proved to be a factor in airline accidents, but also notes that there are not enough of these accidents for such relationships to be indicated statistically. It rejects the Air Line Pilots Association recommendation that pilot fitness should be assessed on an individual basis with no age qualification on the specific grounds that the likelihood of heart attacks and strokes cannot be predicted medically.

When the new rule is imposed on March 15, about 40 pilots will be forced to retire immediately. In the next eight years, the F.A.A. estimates about 250 active airline pilots will reach the retiring age, while many others will have retired voluntarily. Because most airlines select the crews for their new fleets by a seniority bidding method, a large proportion of these pilots are likely to be flying turbine aircraft.

Neither of the British airline Corporations imposes an age limit on its pilots provided they continue to pass the regular proficiency checks and medical examinations (conducted by the Ministry of Aviation). The F.A.A. notes, however, that of the large European airlines it questioned on this point, one had a compulsory retiring age of 60 and the others compelled pilots to retire at 55.

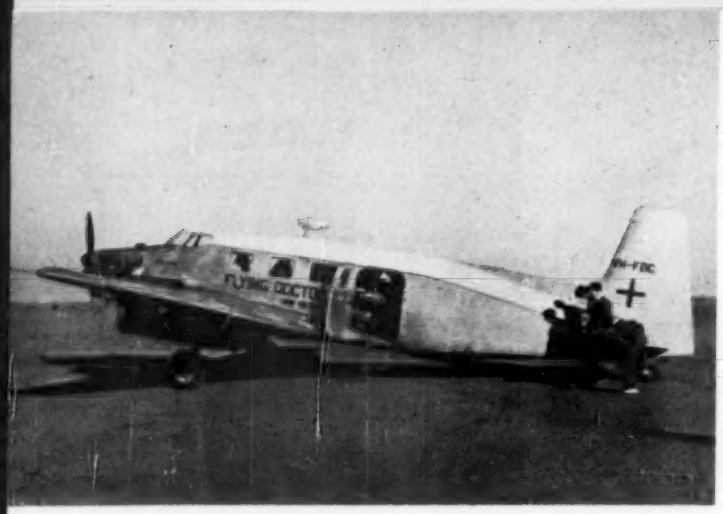
The new regulations concerning training programmes require each airline to obtain F.A.A. approval for its programme, more comprehensive training to be given to co-pilots and annual proficiency checks for co-pilots. Second-in-command pilots in three-pilot crews will be required to take the same training and proficiency checks as the captain. These rules will become effective on January 1, 1961.

The Air-freight Business

ONCE again the latest statistics (for September, 1959) from the Ministry of Aviation for U.K. aerodromes show a vigorous upward trend in freight movement by comparison with the same month of 1958. The tonnage rose by 38% from 22,070 to 30,552 short tons—with Ferryfield's vehicle traffic accounting for 14,836, or 48.5% of the overall total.

The non-vehicle total (about 10,000 tons) for the month looks imposing until it is compared with the total U.K. freight movements by all transport media. Board of Trade figures for the first six months of 1959 show that the proportions of exports and imports carried by air were, respectively, only 4% and 3.2%, though the increases in relation to 1958 were 29% and 33%. Machinery of all kinds provided the biggest single commodity to be air-freighted with 42% of the exports and 35% of the imports coming within this category; the percentage proportions of other commodities are in single figures. The U.S.A. and Europe were our major trading partners, with the former taking 16% of our air exports and sending 20% of our imports.

This month B.O.A.C. will be receiving the first of three new cargo hoist vehicles from Douglas Equipment to speed up the loading and unloading of the big turbojets. The main platform of these vehicles is a completely moving floor consisting of two conveyors which can operate in tandem or independently. With its van-type body the platform can be raised or lowered hydraulically between loading heights of 3 ft. 6 in. and 12 ft. and engages automatically with a drawbridge, over the vehicle's driving cab, which incorporates another conveyor protruding 2 ft. into the aircraft hold.



DOCTOR DROVER.—De Havilland Drovers, built in Australia shortly after the end of the War, are among the aircraft used by the Flying Doctor Service. This one is named "John Flynn" after the Presbyterian missionary who founded the service.

Air Transport . . . .

Air Affairs in the House

WE commented, in our previous issue, on the proposed introduction by B.O.A.C. of economy-class fares to the West Indies, Africa and the Far East. News that the Government had granted B.O.A.C. permission to go ahead with these cabotage route services without IATA agreement (but subject to the approval of the other Governments directly concerned) was the only policy statement contained in Mr. Duncan Sandys first major speech to the House (on December 15) as Minister of Aviation.

Mr. Sandys made it clear that these economy fares are quite distinct from the very low fares proposed by some independent companies. The latter proposals are being examined with the independents and the Corporations together and the Minister said he hoped "that we shall be able to work out solutions which will give some reasonable satisfaction to both parties."

In replying to the debate on the Air Corporations Bill, Mr. Sandys referred to various B.O.A.C. and B.E.A. matters raised by other speakers from both sides of the House. Among the matters still under consideration by the Government were the question of a direct subsidy to B.E.A. for its services to the Scottish Highlands and Islands and the Isle of Man, and of a contribution towards the cost of introducing new aircraft. Both these measures were recommended by the Select Committee on Nationalized Industries in its report on the Corporations last year.

B.O.A.C. had made a profit on its own services of nearly £1 million, after charging interest on capital, in the seven months from April to October, 1959, Mr. Sandys reported. Traffic has increased by 25% over last year, and the Corporation had taken second place to Pan American on the Atlantic. Losses on the associate companies were expected to be reduced from £3 million to about £500,000 in the current year.

Because of the difficulty in selling the stop-gap DC-7Cs—which according to Mr. Sandys, it had been intended to sell when the Boeing 707 became available in 1960-61—they might continue to be used for a longer period in subsidiary roles. B.O.A.C. had no intention at present of buying freighter aircraft such as the Short Britannic. Mr. Sandys also confirmed that Bristol had paid B.O.A.C. a substantial sum because of late deliveries of the Britannia, but this did not fully compensate B.O.A.C. for consequent losses.

The Air Corporations Bill, which received its second reading without a division, increases the borrowing powers of B.O.A.C. from £160 million to £180 million, and of B.E.A. from £60 million to £95 million. These new figures are expected to cover the Corporations' borrowing requirements up to the end of the 1963-64 financial year.

The borrowing powers previously approved had been expected to be adequate until 1960-61, but changes in the Corporations' re-equipment plans and, in particular, orders for the Vickers VC10 and Airco D.H.121 made additional financing necessary. A note of the costs of the new B.O.A.C. fleets, with particular reference to the VC10, appeared in our issue for December 11, page 590.

B.E.A. in October

AS the table below shows, B.E.A. increased its total traffic by 19% in October, compared with the same month last year. The most notable increase was in the freight tonnage, up by 26.5%. In the first ten months of 1959, B.E.A. freight was 25% ahead of the figures for 1958, and the freight ton-miles now exceed 13 million a year. Almost all of this is carried as "fill-up freight" on passenger services, but seven specially converted Dakotas are used for all-freight services.

	October 1959	October 1958	Variation
Capacity ton-miles offered ..	16,070,000	15,220,000	+ 5.6%
Load ton-miles sold	10,796,000	9,061,000	+19.1%
Revenue load factor	67.2%	59.5%	+12.9%
Passengers carried	262,862	222,626	+18.1%
Passenger-miles flown	91,383,000	78,441,000	+16.4%
Passenger load factor	66.9%	60.1%	+11.3%
Freight ton-miles	1,424,900	1,126,400	+26.5%
Mail ton-miles	330,900	357,400	— 7.4%
Aircraft miles flown	3,072,200	2,936,400	+ 4.6%
Revenue hours flown	15,704	15,436	+ 1.7%

Ghana Airways' First Year

IN its first year of operation, Ghana Airways suffered a net operating loss of £174,212. This was less, by some £25,000, than had been anticipated when the airline was set up and can therefore be regarded as a satisfactory beginning for the youngest State airline within the Commonwealth. Total deficit, after allowing for payment of dividend, was £190,118.

The first annual report of the company, recently published, covers the year ended June 30, 1959, although Ghana Airways did not actually come into existence until July 4, 1958. On that date, agreements were signed between the Government of Ghana and B.O.A.C. Associated Companies, Ltd., covering the setting up of the new airline, the training by B.O.A.C. of Ghanaian nationals and the operation in "pool" of the Accra-London service. B.O.A.C. took a 40% share of the issued capital, and the Ghana Government, as the only other shareholder, undertook to underwrite any losses.

Operations on the international service began almost at once, using chartered Stratocruisers in Ghana Airways markings. Since the introduction of Britannias, also on charter from B.O.A.C., this route has become profitable and, in the final three months of the year under review, an operating profit of £10,565 was recorded.

Operation of the domestic and regional services was not taken over from the former West African Airways Corporation until October 1, 1958. To start these services, aircraft were at first chartered from WAAC (increasing the year's deficit by an estimated £40,000), but the company now has its own fleet of two Herons and two DC-3s. The original services were from Accra to Takoradi, Kumasi and Tamale inside Ghana, and to Dakar and Lagos. During the year a service to Conakry, in French Guiana, was opened and a Kumasi-Takoradi leg added to the internal network. In the nine months from October 1, 1958, to June 30, 1959, 17,597 passengers were carried on 1,750 flights—substantially more than in the same period of 1957-58. On the 99 flights between Accra and London, 4,663 passengers were carried.

Recruiting and training of personnel has been a major task. The nucleus was provided by the former WAAC staff in Ghana and Ghanaian nationals serving with WAAC in Nigeria, all of whom transferred to Ghana Airways, with senior administrative and technical staff provided by B.O.A.C. Additional staff for all departments were recruited in Ghana.

A comprehensive trainee scheme, part of the original agreement with B.O.A.C., has started with a view to providing the airline's future management and technical staff. By mid-October, 1959, 23 trainees had been chosen for courses in England, including two pilot trainees; some pilot vacancies remain to be filled.

In addition, nine traffic clerks and some supervisors and semi-senior staff have been, or are being, trained in London, and seven stewardesses and two receptionists have been trained.

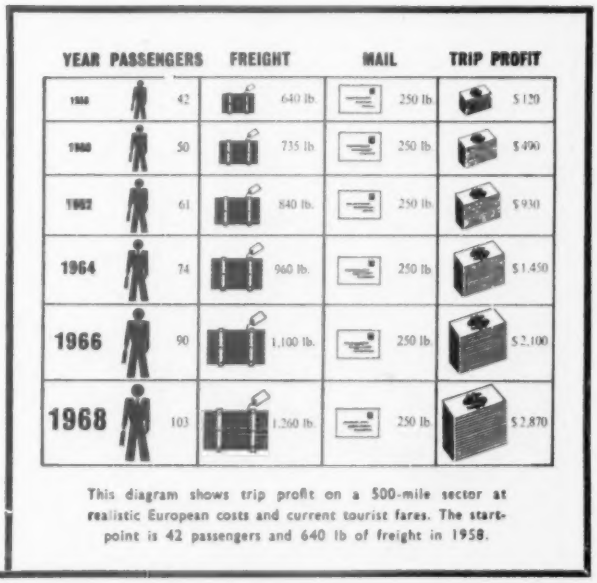
Mr. Victor Akakpo has recently been appointed to the new position of director of Ghana Airways. Mr. James Mercer is chairman and the other members of management are: Capt. G. P. Wood, general manager; Mr. L. C. Giles, deputy general manager; Mr. J. H. Gell, chief accountant and secretary; Mr. C. Gainsford, station manager; Mr. J. G. Williams, chief engineer; and Capt. C. B. Gavin-Robinson, chief pilot.

Only the VANGUARD has this future while making money right from the start

THE VICKERS VANGUARD is designed for growing traffic, yet it will make profits right from its introduction with payloads no bigger than those carried by Viscounts today.

This is clearly shown in the illustration. Profit begins with the first 500-mile trip carrying no more than 42 passengers and 640 lb of freight. Even on modest estimates of traffic and freight increases, its profits will grow considerably with the years.

Assuming a 10% increase per annum in traffic, and 7% in freight, annual and cumulative profit at the end of seven years is remarkably high. By employing the Vanguard's cheap-fare possibilities, payloads and profits could be much higher.



This diagram shows trip profit on a 500-mile sector at realistic European costs and current tourist fares. The start-point is 42 passengers and 640 lb of freight in 1958.

Of all the airliners only the Vanguard has all these features

425 m.p.h. cruising • Freight capacity 7/8 tons at normal densities • Full routeing and A.T.C. flexibility • Can use normal existing airfields • Quick turn-round • No airfield noise problems • Ten years' unique Vickers/Rolls-Royce turbo-prop experience . . . ***And it is 'Viscount' quiet.***

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

• ***The airliner with the biggest profit potential ever offered to the operator***

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

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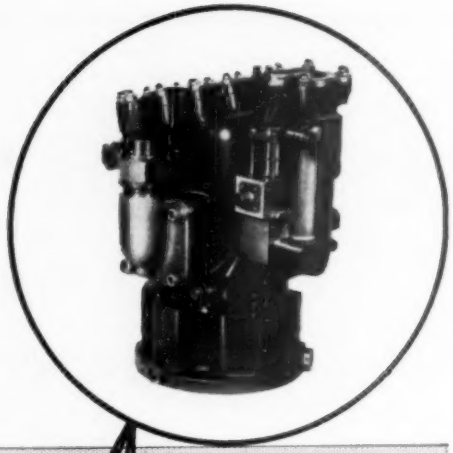
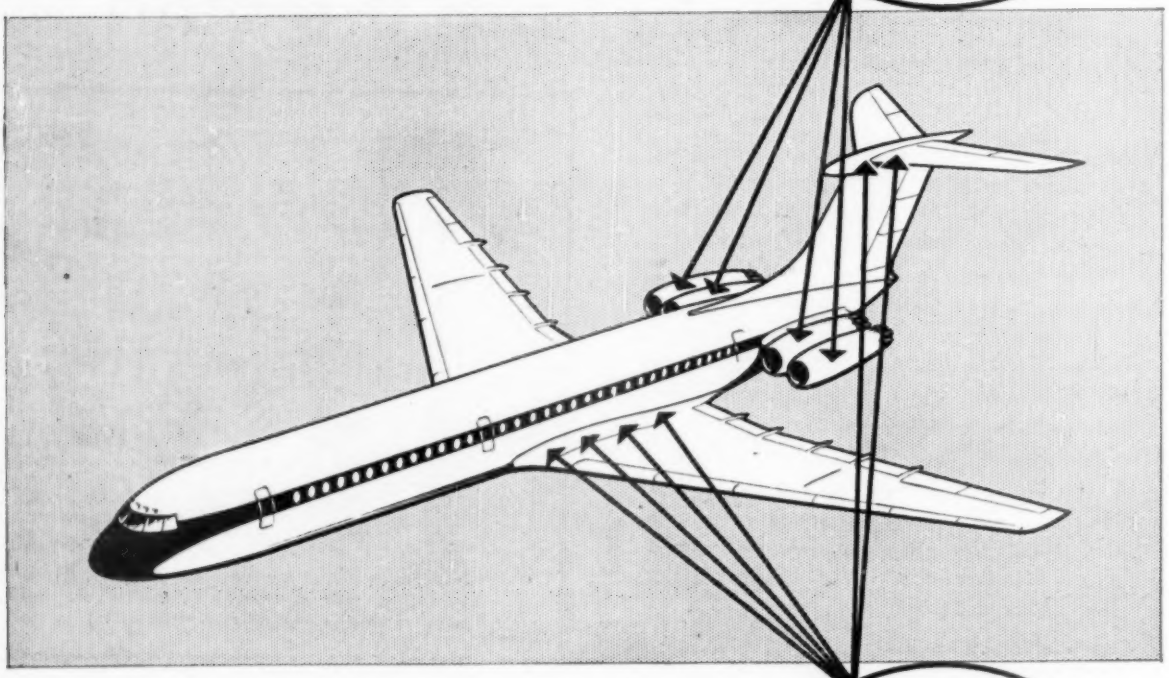
Proven reliability for the V.C.10

VICKERS

Hydraulic Equipment





The engine-driven hydraulic pumps which have been selected for the Vickers-Armstrongs V.C.10 airliner, ordered by BOAC, are of proven VICKERS design and are being manufactured under licence by Sperry Gyroscope Company Limited in the United Kingdom. VICKERS hydraulic motors will also be used for the slats, flaps and tail incidence systems.
The exceptional reliability of VICKERS pumps, motors and ancillary equipment has been established over millions of operational flying hours in civil and military aircraft.

SPERRY GYROSCOPE COMPANY LIMITED

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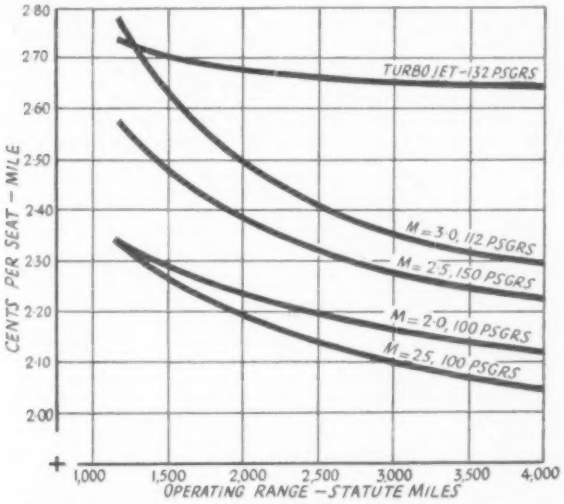
Air Transport . . . .

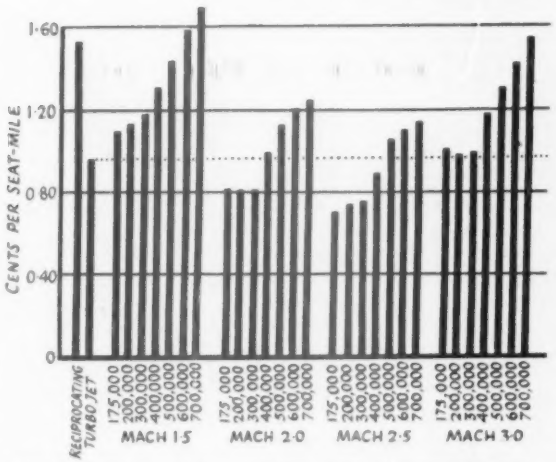
Supersonic Transport Economics

IN commercial airline operation, supersonic transports can be competitive with subsonic turbojets, and far superior to reciprocating engined aircraft. Costwise, a Mach 2.5 aircraft with a take-off weight in the range 175,000 lb.-300,000 lb. is the most economic of supersonic transports, but the growth potential of a Mach 3.0 configuration makes this speed also worthy of consideration. By 1970, as many as 200 Mach 3.0, 100-seat transports could be needed for stage lengths over 1,000 st. miles.

These are among the surprising conclusions reached in "An Economic Study of Supersonic Transports" undertaken by Planning Research Corp. of Los Angeles and Washington, U.S.A. The study was made under contract to the Air Research and Development Command, U.S.A.F., with three principal objectives: to make a comparative economic analysis of reciprocating, subsonic turbojet and supersonic transport aircraft, both military and civil; to analyse the value of speed to the military logistic system; and to forecast the potential demand for a civil supersonic transport. A summary of the study results has recently been published.



Total seat-mile costs of hypothetical supersonic transports plotted against range. Seating capacities were based on a 3,500-naut.-mile design range and could be increased for shorter ranges, with benefit to seat-mile costs.



Forecast direct operating costs for a series of supersonic transports, over a 2,500-naut.-mile stage, based on the A.T.A. method and assuming 100 aircraft sold, spares totalling 10% of first cost, 10-year depreciation to 10% residual and 8½ hr. daily utilization.

Scope of the Survey. A series of generalized supersonic transports was used as the basis for the study, taking actual design proposals by U.S. manufacturers to establish feasible performance criteria in the 1960-1970 period. The aircraft considered fell within the following limits, and were examined in all possible combinations:—

Take-off weight:	175,000-700,000 lb.
Speed:	Mach 1.5-Mach 3.5
Range:	1,000-4,500 naut. miles

No attempt was made to optimize a particular design within these parameters.

Cost Forecast. Diagrams on this page indicate the principal results of the study relating to commercial supersonic transports.

It will be seen that the direct operating costs are almost all lower than those of a reciprocating (DC-7 type) aircraft, and in many cases lower than the subsonic (Boeing 707/DC-8 type) turbojet. The lowest costs for a 2,500-st.-mile range are developed by a Mach 2.5 transport with a weight between 175,000 lb. and 300,000 lb. Comparing a 175,000-lb., Mach 2.5 transport with a subsonic jet, it is found that fuel costs are the same (at 0.37 cents per seat-mile) but the crew, maintenance and depreciation/insurance items are 35-50% lower, in terms of cost per seat-mile, because of the higher productivity of the supersonic type.

When indirect costs are added to direct costs, supersonic configurations for Mach 2.0, Mach 2.5 and Mach 3.0 at weights up to 300,000 lb. are cheaper than the subsonic types, over the 2,500-st.-mile sector.

Market Forecast. In order to estimate the likely market for supersonic transports betw en 1960 and 1975, a prediction of air travel growth was made. It was assumed that all stage lengths over 1,000 st. miles were potentially suitable for supersonic operation.

The forecast total traffic by 1975 was 205,300 million passenger miles, made up of 108,600 million U.S. domestic, 29,000 million U.S. international and 67,700 million foreign carrier international. Of this total, 116,700 million passenger miles are forecast to be over stages of at least 1,000 st. miles.

It is a historical fact, says the report, that at any particular time the fastest and most modern aircraft types carry about 60% of the commercial airline traffic carried or seat-miles offered. The report therefore assumes that the market for supersonic transports can be based on 60% of the total market on stages over 1,000 st. miles. Passenger load factors are assumed at 60% and utilization at eight hours a day. On this basis, the numbers of aircraft likely to be required are shown in the table alongside.

The assumptions on which these estimates are based appear to disregard technical and operating difficulties and seem likely to be over-optimistic.

Supersonic Transport Requirements—1965

Minimum Trip Distance	Mach 2				Mach 3			
	50 seats	100 seats	150 seats	200 seats	50 seats	100 seats	150 seats	200 seats
1,000 st. miles	340	165	110	85	265	135	90	70
1,500 st. miles	195	95	70	55	165	80	60	40
2,000 st. miles	125	60	40	30	95	45	35	25
2,500 st. miles	70	35	20	15	50	30	20	15

Supersonic Transport Requirements—1970

1,000 st. miles	540	270	175	140	390	195	140	100
1,500 st. miles	345	170	110	85	250	130	90	60
2,000 st. miles	200	100	70	50	145	75	50	35
2,500 st. miles	125	60	45	25	85	40	25	20

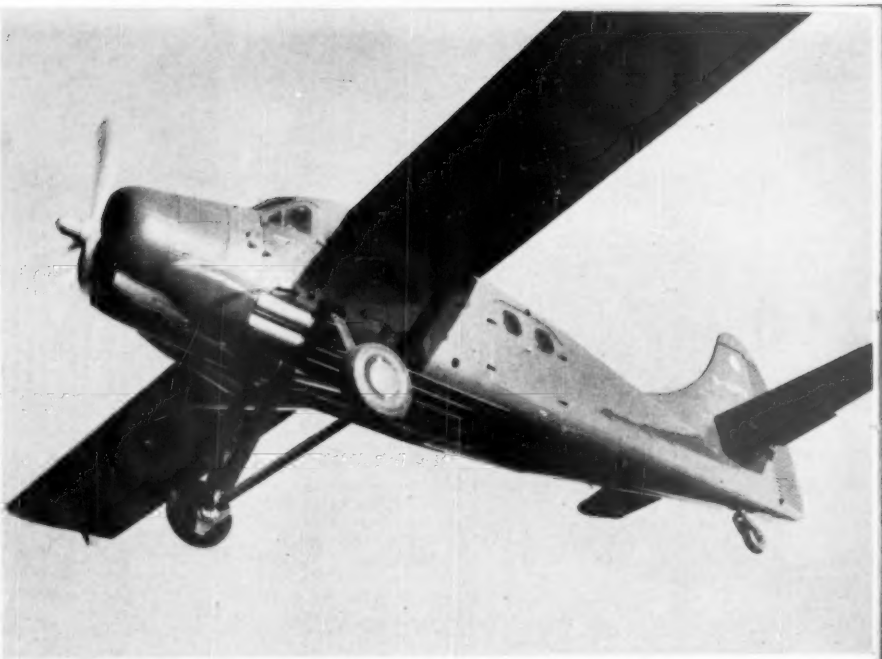
Supersonic Transport Requirements—1975

1,000 st. miles	720	340	235	180	545	275	180	140
1,500 st. miles	440	220	150	120	330	170	110	90
2,000 st. miles	285	145	95	70	200	100	70	55
2,500 st. miles	180	90	60	40	130	60	45	30

THE AEROPLANE
and ASTRONAUTICS

Flying the STOL Otter

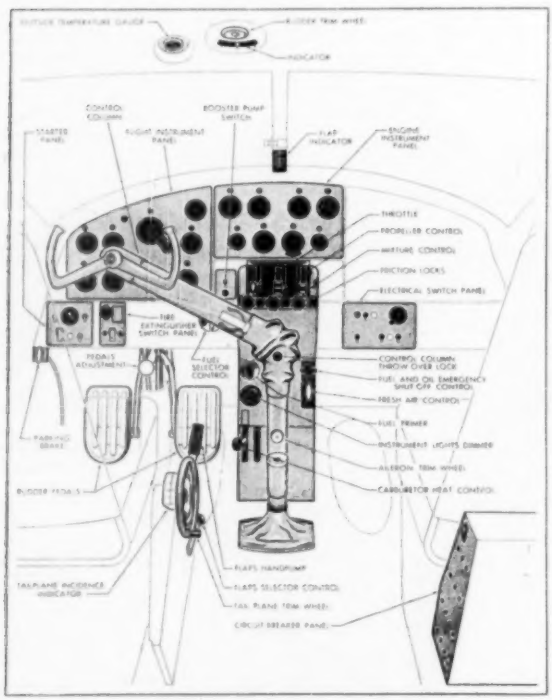
by John Fricker



SHORT take-off and landing aircraft are receiving much belated attention nowadays, and we have seen a large number of slightly curious solutions to the problems of obtaining near-helicopter performance with fixed-wings. Unfortunately, the complication involved in achieving high lift coefficients at low speeds often results in costs, both initial and operating, which are still excessive in comparison with those of conventional aircraft.

The success of the Otter, following D.H. Canada experience with more than 1,300 Beavers, has been in demonstrating that virtual STOL performance can be achieved in a fairly large aeroplane without undue design complication, and its attendant penalties on cruising performance and payload. In keeping with this philosophy, the Otter has no slats, its high aspect-ratio wing being of a special D.H. maximum-lift section, with double-slotted flaps extending over the entire span. The outer sections also operate differentially as ailerons.

Flap and aileron surfaces, which are of all-metal construction, together account for one-third of the gross wing area. With their assistance, the Otter can operate in and out of a 450-yd. field, surrounded by 50-ft. trees, in zero wind conditions on the 600 b.h.p. of its single Pratt & Whitney R-1340 engine, while carrying up to 11 people each with 130 lb. of baggage, or more than 3,000 lb. of freight.



The Otter has a simple and effective cockpit layout, and is normally fitted with a "throw-over" type control wheel.

This performance, remarkable enough in itself, is achieved within the confining framework of the ICAO Flight Manual figures. Like other aircraft of its type, even more startling STOL capabilities can be realized, as I discovered during a recent "indoctrination" at Hatfield, when the Otter is flown to its optimum handling techniques. To conform to such items as climb gradients and operating speed margins for conventional aeroplanes imposes severe penalties on STOL types and minimizes the advantages of their design.

Some modification seems necessary to the performance specifications in B.C.A.R.s for these specialist aircraft. Careful consideration would be required in framing alterations in the Airworthiness Requirements to ensure adequate safety factors. Single- and multi-engined designs, however, requiring less than a certain length of operating surface and conforming to specified flight handling characteristics, should qualify for approved operation close to optimum techniques.

In the case of the Otter, the effect of such approval would be to shorten take-off and landing distances by 20%. At the maximum weight of 8,000 lb., the landplane version has a nil-wind take-off distance to 50 ft. at sea level (I.S.A.) using ICAO techniques, of 1,640 ft. With optimum handling, however, under identical conditions, this falls to 1,310 ft., while corresponding landing distances from 50 ft. are 1,195 ft. (ICAO) and 955 ft. (optimum).

Such improvements hinge mainly on operating much closer to the stall or minimum control speeds than is permissible with conventional aircraft. They presuppose the sort of low-speed docility displayed by the Otter, which is now completely viceless. In its earlier form, a strong trim-change made itself evident under certain conditions and flap settings, but this has been rectified by a flap/trim tab linkage.

The Otter has a full public transport C. of A. validation in the U.K. and many other countries. More than 350 have so far been delivered, about two-thirds to the air forces of Canada, Chile, Colombia, India, Indonesia and Norway, as well as the U.S. Army and Navy, and the remainder to civil companies throughout the World. Four national expeditions in Antarctica have used the Otter for transport, reconnaissance and photography, and the sole R.A.F. example, XL 710, made a memorable 11-hour flight across the South Pole in 1958.

Equipped with skis, the Otter is in its second element when operating from snow and ice, and it is equally at home on floats, or on combinations of wheels, skis and floats. Its seaplane capability is apparent, to the initiated, by the cabin entrance door on the starboard side, in addition to the double freight doors opposite, for access to either float. There is also a small external door on both sides of the cockpit, for use when bulky loads prevent access through the cabin.

Standard accommodation layout is for nine passengers, in seats which can be rapidly folded against the wall, flush with the lower heater duct. Numerous strong points, with removable screw pickets, are provided for freight lashing, and there are attachment fittings for six stretchers. An extra jump seat can be installed in front of the door in the rear bulkhead, behind which is a large camera or cargo drop hatch and, for maximum

payload, an eleventh passenger may be carried in the co-pilot's seat.

Cabin headroom is just under 5 ft., and overall length, with the removable rear bulkhead displaced, is more than 16 ft. Optimum payload of the Otter is about a ton, which may be carried over more than 1,000 miles. For my familiarization flights at Hatfield, which were undertaken with D.H. sales pilot George Thornton, we were operating at a fairly light weight, with about 110 gal. of fuel in the three underfloor tanks and 150 lb. of ballast in the aft compartment. This gave us a forward C.G. position, at about 22.5% M.A.C., and a flying weight of some 6,000 lb.

After an external check of G-AOYX, which stood rocking gently in a gusty wind on its sturdy undercarriage of classic triangular strut-form, with fat, low-pressure tyres, the autumn sun glinting on its khaki metal skin, I climbed into the cockpit through the forward cabin bulkhead. As usual on these occasions, I started off observing in the right-hand seat, before changing places to gain some first-hand impressions.

The Otter normally has a "throw-over" type control wheel on a cranked central column but, as the D.H. demonstrator, G-AOYX has a dual extension for the right-hand occupant. Dual rudder-pedals are also provided, without toe-brakes. Cockpit layout is simple and straightforward, as in the Beaver, with a full blind-flying panel on the left and engine instruments in the middle. At the top of a central console are throttle, pitch and mixture levers, each with its individual friction knob below, while on the left are booster pump switches and fuel selector cock for the front (51 Imp. gal.), centre (85 gal.) and rear (42 gal.) tanks.

On the side of the first-pilot's seat is the low-geared hand-wheel for the adjustable tailplane, with an adjacent incidence indicator. A smaller wheel in the roof is for rudder trim. Forward of the tailplane wheel is a selector lever and hydraulic hand pump for flap actuation, with an indicator strip above the centre instrument panel. Returning the selector lever to neutral after raising or lowering the flaps by a few strokes of the pump also serves as an additional safety lock.

A mechanical connection between the flaps and a tab on the port elevator maintains approximate longitudinal trim at all deflections. Limited lateral trim is possible via a small knob at the base of the control column, which varies the tension of the aileron cables. The port rudder pedals are adjustable for leg length, and the seat for height.

With these facilities, and the convenient control layout, one soon feels at home in the Otter. It is unusual, for a single-engined tailwheel type, in offering a good forward view from the pilots' high vantage points, even on the ground. Sideways visibility is marred only by the thick frame members, since the cockpit is well forward of the wing. More rearward vision would be an asset, as the sliding side windows are rather small.

The closely cowled and supercharged R-1340 radial engine, which has proved its reliability over hundreds of thousands of hours of Harvard operations, bursts into life with a healthy bellow from its four exhaust ejector tubes. These provide forced cooling at slow forward speeds and high power settings, together with a measurable amount of thrust. For permanent operation in very cold weather conditions, smaller-diameter augmentor tubes may be fitted, to prevent over-cooling.

After an impressive demonstration by George Thornton of the Otter's STOL capabilities, from an obstruction-flanked 200-yd. strip of grass between the perimeter track and the runway at Hatfield, I moved over to the left-hand seat for a more cautious exploration. The same into-wind strip was used, and I taxied out to it with the help of the Otter's electrically steered tailwheel.

This is an optional installation for wheel- or ski-equipped Otters which greatly facilitates cross-wind taxi-ing and general ground manœuvrability. Tailwheel steering, via an electric rotary actuator with an integral magnetic clutch, is selected by a switch on the centre panel. Alternative selections provide for tailwheel lock or castor, and coloured warning lights indicate the engaged positions.

The tailwheel should be locked, or the steering disengaged for take-off and landing. Under power, it turns at about 18°/sec. up to 28° each side of centre. The toe-brakes are effective for taxi-ing without tailwheel steering, and the Otter squashes along pleasantly on its classic D.H. rubber-in-compression undercarriage.

The Otter Airborne

With a double check to ensure that the elevator trim wheel was within the take-off segment, I opened up to 36 in. Hg. and 2,250 r.p.m., feeding in some right rudder to keep straight during the brief ground run. Like all STOL aeroplanes, the Otter feels tail-heavy on pushing the stick forward from the three-point attitude, at which it unsticks quite happily with very little assistance at about 50 m.p.h.

It then goes up like a lift, using optimum flight techniques, keeping fairly flat with the airspeed around 65 m.p.h. for the maximum obstacle clearance. The climb attitude results from the take-off flap setting, which is not far off full extension. Once airborne, the flaps are therefore retracted fairly smartly, for a maximum rate climb, or left at 15° for maximum angle. No sink accompanies their retraction, but they are best pumped up in short stages, with a twist of the tailplane trim wheel in between to keep the nose sufficiently raised in the climb.

Maximum continuous power of 33 in. Hg. and 2,200 r.p.m. may be maintained, with an airspeed of 90 m.p.h. for the best rate of climb. Right rudder trim, via the little roof wheel, relieves the foot loads during the ascent, which indicated 1,200 ft./min. on the V.S.I. at our light weight.

Directional trim, in fact, now appears to be the most changing factor in the Otter. The foot loads, as with all the controls, are light at all times, however, and the trimmer is precise and effective.

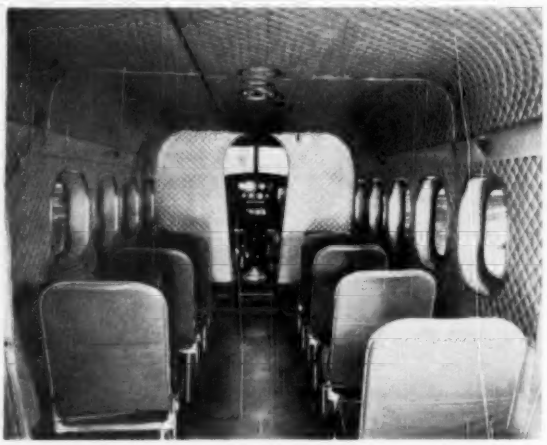
A characteristic of all the large control surfaces, and particularly the rudder, is that a gentle buffet or snatch is just perceptible through them in some conditions of flight. I have noticed this peculiarity on other STOL aeroplanes.

It can barely be detected in cruising flight, at 27.8 in. Hg. and 1,700 r.p.m. (325 b.h.p.), when the Otter settles down to about 124 m.p.h. I.A.S., for a lean mixture consumption of some 21½ gal./hr. Trimmed at that speed, the Otter completed 2½ phugoids, stick free, after a 10-m.p.h. reduction, before returning to level flight. After a 10-m.p.h. increase in air-speed, 1½ rather slower oscillations followed to indicate the positive longitudinal stability.

I thought the Otter handled very well in the cruising range

More than 350 Otters have so far been built by de Havilland Canada, and are in service throughout the World. They are particularly suitable for undeveloped areas, which accounts for the fact that G-AOYX, de Havilland's U.K. demonstrator, is the sole Otter on the British register. In its utilitarian khaki finish, it is seen here over the winter countryside near Hatfield.

Photographs copyright "The Aeroplane and Astronautics"



For passenger transport the well sound-proofed cabin of the Otter is normally furnished with nine lightweight folding seats, but it can carry up to 12 persons, including the pilot. Optimum payload is about a ton.

for an aircraft of its type, with pleasantly positive ailerons matching the elevators in requiring only moderate forces, and a slightly heavier rudder. Directional stability, with the big fin, is naturally pronounced except at minimum airspeeds, and laterally, the Otter is about neutral, which is normal. I found no necessity to touch the aileron trim. Never-exceed speed is comfortably high at 192 m.p.h.

Aileron effectiveness at various speeds was measured by stop-watch timing the Otter's rate of roll from a 45° bank in one direction, to the same angle in the other. Torque reaction resulted in small differences between right and left bank response, but, in round figures, the rate of roll at cruising speed proved to be some 45°/sec. At 80 m.p.h., with a little flap, it fell to about 30°/sec., the ailerons becoming slightly heavier as they drooped with flap extension.

In the approach configuration, with full flap, and the speed at a comfortable 60 m.p.h., the inertia of the near-60-ft. wing became noticeable. Aileron forces remained moderate, but some assistance from the rudder was desirable for the optimum response. At about 22°/sec., the resultant rate of roll was then quite acceptable, following full rotation of the control wheel.

From the approach configuration, closing the throttle to explore the stall necessitated a fair amount of aft trim to prevent the nose dropping. A strong aft heave on the control column was accompanied by the stall warning light starting to wink at about 47 m.p.h. I.A.S., and a little elevator buffet. With the wheel about three-quarters aft of its travel, the break-away comes at about 42 m.p.h. I.A.S., after a moderate yaw to port. The Otter sinks with a mild drop of the nose and perhaps one wing, although aileron control remains throughout. Maximum height loss, trimmed from 1.4Vs, is 290 ft.

With take-off flap and power, the Otter behaves similarly, the speed going "off the clock" at 40 m.p.h. before the gentle stall. Clean, the Otter requires very strong elevator pressure to achieve minimum speeds, and a substantial amount of right rudder and appropriate aileron to keep straight. Power on, with the stick fully aft, there is a slight reversal of the heavy elevator force, but light forward pressure accomplishes rapid recovery from the stall, at which there appears to be a fairly large position error.

The remaining test to be done while we were at a reasonable height was to check the trim change on overshooting from the approach configuration, but the flap/tab interconnection made this a routine business involving only a one-handed push force. It also cleared the way to try some STOL landings, which promised to be highly entertaining. The technique I was shown was to get opposite the touch-down point on the downwind leg, at about 800 ft., to close the throttle, apply full flap, and spiral down in an extremely steep descent for a full-blooded power-off approach at 55 m.p.h. I.A.S.

This is some 20 m.p.h. below the Flight Manual speed for public transport operation, but still gives a substantial margin over the indicated stalling speed. Flap can be lowered progressively below 100 m.p.h., and a trickle of power used to regulate one's aim at the touch-down point. Flap movement is accompanied initially by a slight nose-up trim change, which reverses in the final stages of travel.

On my first approach, we hovered over the boundary of Hatfield at about 400 ft., and it seemed impossible that we would be able to get into the short stretch of grass before the runway. On removing all power, however, the Otter came down like a bomb, the V.S.I. indicating about 1,200 ft./min. descent. With a little aft trim to maintain 55 on the A.S.I., I waited until the ground was almost too close for comfort before landing the Otter in two simple movements.

One pull on the wheel to just aft of centre levelled the fuselage from its pronounced nose-down attitude, and instantly checked the descent. A second pull, immediately afterwards, to about three-quarters aft travel, put the Otter into the three-point attitude, from which it squashed gently on to the ground, with no trouble at all. With the stick clutched to one's corporation, brakes can then be applied to stop dead within little more than 100 yd. This sort of performance can still be achieved up to the maximum gross weight of 8,000 lb., using an approach speed of 63 m.p.h. I.A.S. in calm air.

I did not try a higher-speed landing to the ICAO technique, but I became thoroughly familiar in the course of several circuits in two separate flights with the Otter's stimulating STOL performance. Its powerful controls permit this to be fully exploited, with the help of its low-speed docility, but this sturdy type is easy and pleasant to fly.

Price of the Otter, in standard form, is around $94,500, f.a.f. D.H. skis cost about $2,000 and combination wheel-skis some $4,500. Edo floats for the Otter cost in the region of $10,720 and amphibian floats $27,668.

Leading Particulars

DIMENSIONS.—Span, 58 ft.; length, 41 ft. 10 in.; height, 12 ft. 7 in.; gross wing area, 375 sq. ft.

WEIGHTS (Seaplane in parentheses).—Basic, 4,311 lb. (4,778 lb.); disposable load, 3,629 lb. (3,189 lb.); payload over 500 miles, with reserves, 2,374 lb.; gross, 8,000 lb. (7,967 lb.).

PERFORMANCE (At max. gross weight—seaplane figures in parentheses).—Max. level speed, 160 m.p.h. (153 m.p.h.) at 5,000 ft.; economical cruise, 130 m.p.h. (120 m.p.h.) at 8,000 ft.; initial climb, 850 ft./min. (750 ft./min.); service ceiling, 17,400 ft. (16,400 ft.); stalling speed, 58 m.p.h.; take-off run, zero wind, ICAO technique, 820 ft. (1,240 ft.), optimum technique, 655 ft. (990 ft.); distance to 50 ft., ICAO technique, 1,640 ft. (2,480 ft.), optimum technique, 1,310 ft. (1,980 ft.); landing run, ICAO technique, 550 ft. (865 ft.), optimum technique, 440 ft. (690 ft.); distance from 50 ft., ICAO technique, 1,195 ft. (1,520 ft.), optimum technique, 955 ft. (1,210 ft.); cruising range, 889 miles (824 miles) at 5,000 ft.; max. endurance, 9.8 hr. (8.8 hr.).

For a utility aeroplane the Otter has exceptionally pleasing and compact lines, which assist in the achievement of a good cruising performance. G-AOYX is fitted with a Hamilton Standard Hydromatic airscrew, which is an alternative to the counterweight type by the same manufacturer.

Photograph copyright "The Aeroplane and Astronautics"

SEA TRIALS.—During naval assessment trials a Turmo-engined Saunders-Roe Wasp has been operated from a platform on a frigate both by night and day.

Progress Report on the Saro Wasp

ORIGINAL plans called for the first production version of the Saunders-Roe P.531 helicopter to enter service with the Blackburn Turmo engine, but development of Blackburn's A.129 free-turbine engine has been so rapid that this 968 s.h.p. powerplant will be installed in all production P.531s. This general-purpose helicopter has been developed as a private venture by Saunders-Roe and the company's enterprise has already been rewarded by a naval order. There is also considerable overseas interest in this versatile helicopter.

In point of fact, the Royal Navy have already taken delivery of the aircraft to their initial order. This was for evaluation, and has been built to the original prototype standard but suitably modified for operation at sea. If trials are successful a larger production order for the standard version of the P.531 fitted with the A.129 engine may be obtained. The naval P.531 has been named the Wasp.

This standard version of the P.531 is designated the P.531-2. Interest is also being shown by the Army and Royal Air Force, and the Ministry of Aviation is at present negotiating a contract for a number of aircraft to be developed for the Army Air Corps.

The basic design philosophy of the P.531 lies in the combination of a light, but powerful, free-turbine engine with a rotor having a high disc loading. This has permitted a light helicopter to be produced with a considerable reserve of power for operation at high altitude and in tropical conditions.

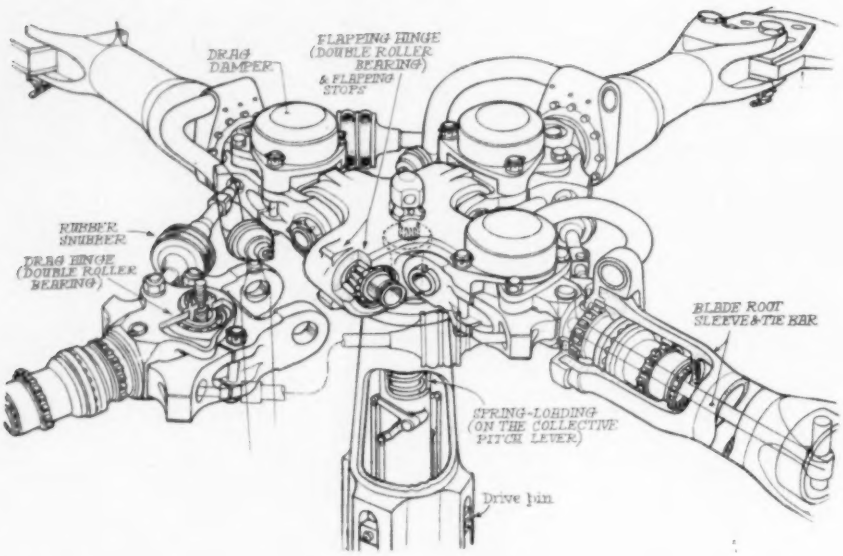
Although the P.531's engine can deliver nearly 1,000 s.h.p., the rotor transmission is designed to take only 650 s.h.p. Thus, during normal low-level operation the engine is in effect de-rated, but reserve power is available and sea-level I.S.A. performance can be maintained up to 7,000 ft. in I.S.A. +30° C. conditions. Only when conditions become even more exacting does the full-throttle output of the A.129 fall below 650 s.h.p. and the performance of the helicopter is reduced.

A noteworthy feature of the P.531 has been its rapid development. Project design began in December, 1957, the go-ahead

PRODUCTION HELICOPTER.—The latest version of the Wasp, the P.531-2, has a 968-s.h.p. Blackburn A.129 free-turbine engine.

SAUNDERS-ROE P.531-2 MILITARY HELICOPTER

One 968-s.h.p. Blackburn A.129 Free-turbine Engine


DRAG DAMPER
FLAPPING HINGE (DOUBLE ROLLER BEARING) & FLAPPING STOPS
RUBBER SNUBBER
DRAG HINGE (DOUBLE ROLLER BEARING)
BLADE ROOT SLEEVE & TIE BAR
SPRING-LOADING (ON THE COLLECTIVE PITCH LEVER)
Drive pin

for prototype construction was given in January, 1958, and the first Blackburn Turmo-engined aircraft flew in July that year. Little more than a year later the first A.129-engined helicopter was flying.

Already five P.531s have been built and flown, and more are under construction. By the end of November last year P.531 flying time totalled 270 hours. Saunders-Roe has been particularly pleased with the performance of the A.129 engine during flight trials.

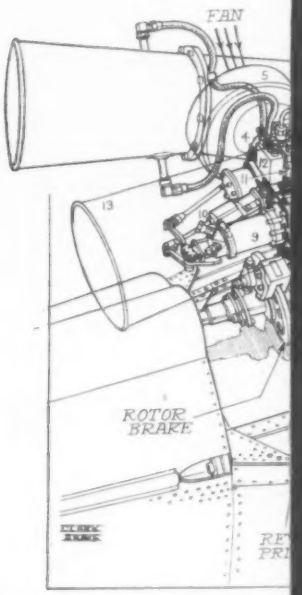
Production Aircraft

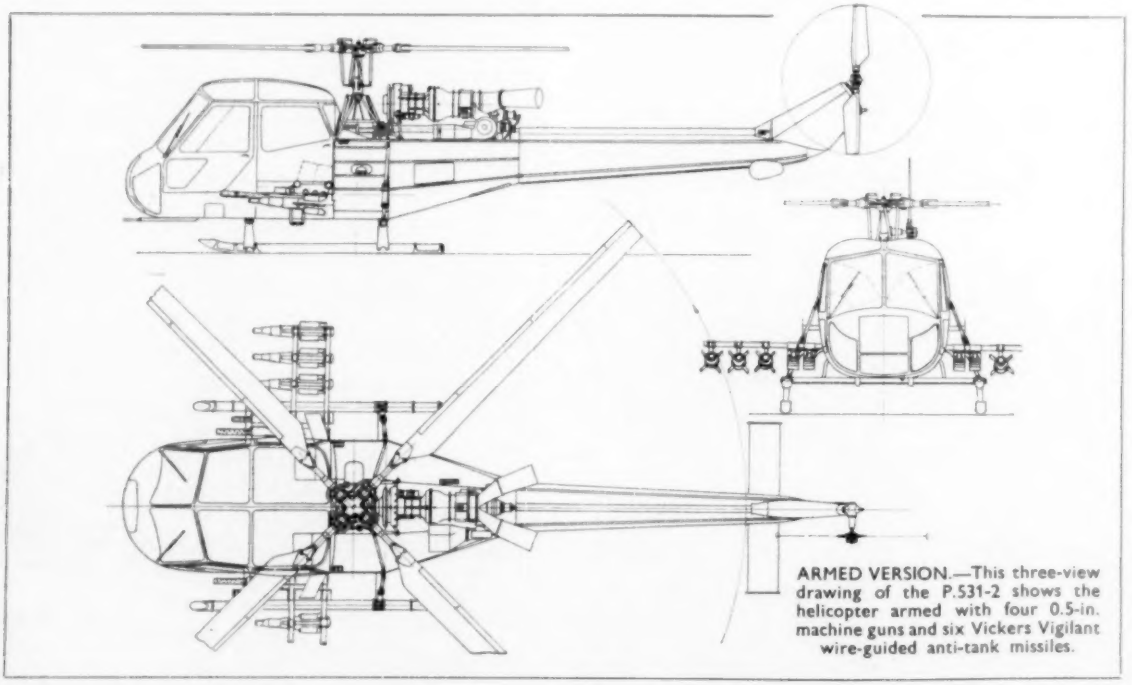
The initial production helicopter, the P.531-2, has an all-up weight of 5,000 lb., compared with 4,000 lb. for the prototype, which was fully described in THE AEROPLANE for August 8, 1958. Later production versions will have an A.129 engine rated at 1,150 s.h.p. and the all-up weight is expected to be increased. In addition, the power which can be absorbed by the transmission should be increased above the present 650 s.h.p. It is hoped that this version will be able to take-off at 14,000 ft. in maximum tropical conditions (I.S.A.+30° C.) at normal all-up weight.

Differences between the prototype and the P.531-2 include a fuselage which is 6 in. longer and has a better aerodynamic shape; it also has increased capacity and better servicing facili-

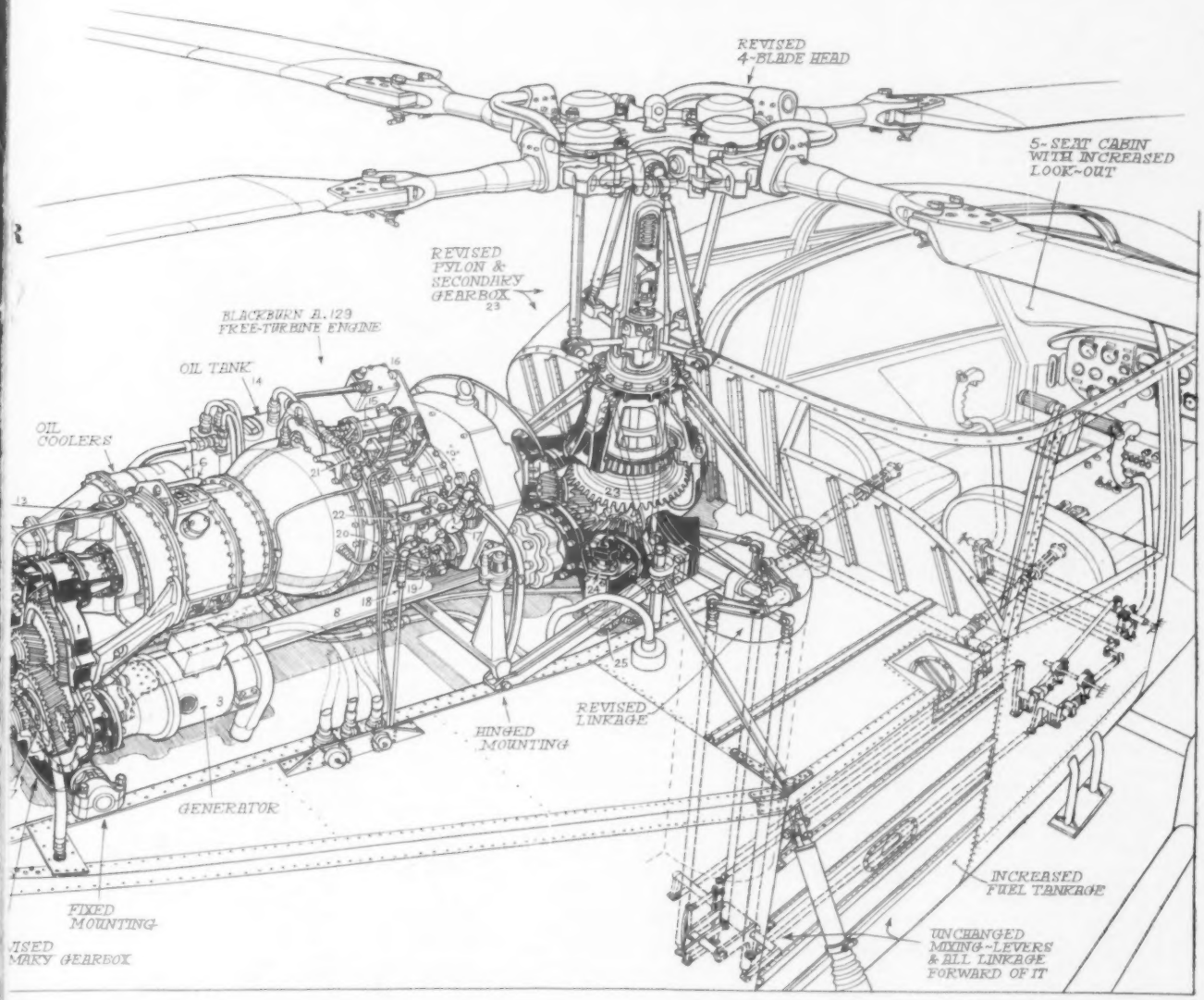
KEY

1. Primary gearbox with drive (2) to generator (3).
4. Similar drive to fan (5) passing air through coolers (6).
7. Built-in freewheel to transmission shaft (8).
9. Fuel governor and electric actuator (10).
11. Fuel over-ride (collective pitch increase).
12. Collector box (jet pipe exhaust temperatures and oil system).
13. Jet pipes.
14. Oil tank (engine and primary gearbox).
15. Inlet guide-vane pitch control.
16. High-energy ignition unit.
17. Fuel pump and metering unit.
18. Gas-generator throttle.
19. Oil pump.
20. Starter.
21. High-pressure fuel cock.
22. Torch igniter solenoid.
23. Secondary gearbox with tachometer (24) and oil pump (25).





ARMED VERSION.—This three-view drawing of the P.531-2 shows the helicopter armed with four 0.5-in. machine guns and six Vickers Vigilant wire-guided anti-tank missiles.



ties. The cabin floor area has been increased so that up to five people can be accommodated, in addition to the pilot, and the view from the cabin has been improved by the addition of Perspex panels in the door and nose and changes to the windscreen shape.

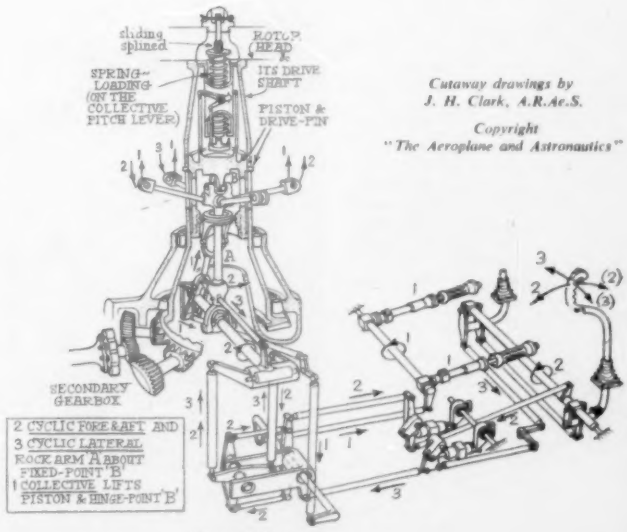
Ease of servicing—a basic design requirement for the P.531—has been improved by the external installation of the tailshaft, which is now easily accessible via spine covers on the top of the tailboom. As with the prototype, external mounting of the engine makes for simpler maintenance.

Other changes include minor detail improvements to the control runs, fuel tankage increased from 126 gal. to 160 gal., and the use of all-metal rotor blades. These blades, produced in the U.S. by the Parsons Corp., are a development of the standard blade used on Hiller helicopters. It is expected that they will be cleared for an infinite life and will be produced under licence in the U.K.

The transmission has been redesigned and strengthened for installation of the Blackburn A.129 Mk. 3 free-turbine engine. The main rotor is driven from the primary gearbox mounted at the aft end of the engine, via an intermediate shaft which drives two helical gears on torsionally flexible shafts in the secondary gearbox. These shafts each carry a helical bevel gear; these mesh with a crown wheel at the lower end of the main rotor shaft.

Automatic governing has been installed so that a selected rotor speed is maintained regardless of the collective-pitch setting. A constant-speed unit automatically matches engine power output to rotor requirements. The pilot can revert to manual engine control for training or in an emergency.

Considerable effort has been devoted to development of the P.531 as an all-weather helicopter. Although a considerable weight penalty follows from the wide range of equipment necessary, this has been counterbalanced by the increase in all-up



Cutaway drawings by J. H. Clark, A.R.Ae.S.

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Control System

FRIGATE OPERATION.—Practice-bomb racks can be seen on this Wasp which made 31 night landings on the frigate H.M.S. "Undaunted" during December.

weight, for which ample power is available; in any case, all-weather capability is well-nigh essential for modern operational helicopters.

Equipment available for installation in military versions includes a three-axis autostabilization system with cruising autopilot facilities; cabin heating and demisting; cargo sling; lightweight air-driven hoist; weapon carriers; and a comprehensive range of radio, navigation and night-flying equipment. Windscreen de-icing has been incorporated and a later development will be rotor-blade de-icing.

Although at a superficial glance the P.531 appears to be a small helicopter, it is, in fact, more powerful than larger helicopters in current use—such as the Whirlwind—and has a performance which is much less affected by hot-weather high-altitude operation. Designed from the start to meet the needs of the World's armies, navies and air forces, the basic helicopter can be used in a wide range of rôles. For naval service it can operate in the anti-submarine rôle as a carrier of homing torpedoes; later versions may act as search and strike aircraft, carrying dunking sonar as well as torpedoes. Other naval applications of the P.531 are for air-sea rescue, liaison, light freighting and training. Three people can be rescued at distances from base of up to 180 miles.

For army use, the main duty of the P.531 is likely to be liaison, particularly in forward battle areas; other rôles will be unarmed reconnaissance, including day and night photography; casualty evacuation; armed reconnaissance carrying weapons such as 0.5-in. machine guns, wire-guided anti-tank missiles and 2.75-in. unguided rockets; light freighting and training.

For air force use, the main rôles of the P.531 would probably be training, air-sea rescue, liaison and casualty evacuation.

Although developed primarily as a military helicopter, civil applications for the P.531 will not be neglected and Saunders-Roe plan to obtain civil airworthiness certification for it as soon as possible. Civil uses for the P.531 include executive transport, ambulance work, crop spraying, aerial survey and light freighting.

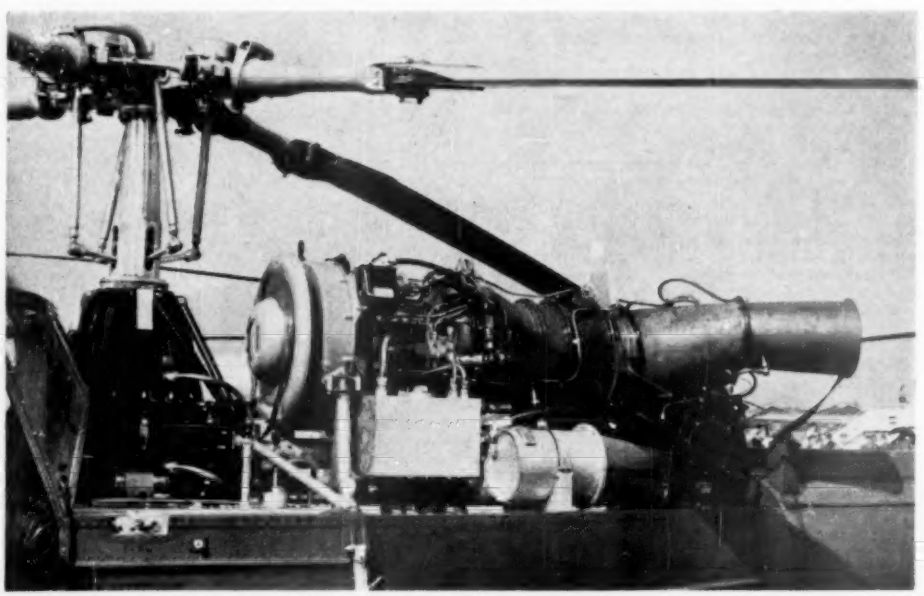
Technical Data—P.531-2

DIMENSIONS:—Main rotor diameter, 32 ft. 3 in.; tail rotor diameter, 6 ft. 2 in.; overall length with main rotor blades folded, 30 ft. 4 in.; overall width, 8 ft. 5 in. (blades folded); overall height, 10 ft. 5 in. (with blades rotating).

POWERPLANT:—One Blackburn A.129 Mk. 3 free-turbine engine; maximum five-minute power in I.S.A. conditions, 968 s.h.p.; maximum one-hour power, 885 s.h.p. Fuel tankage, normal, 158 Imp. gal.

WEIGHTS:—Empty, 2,836 lb. (fully equipped less radio); normal all-up weight, 5,000 lb.

PERFORMANCE (at normal all-up weight with four passengers):—Cruising speed, 105 kt.; max. speed, 115 kt.; max. range, 220 n.m. (normal tankage with 10% reserve); max. endurance, 3.5 hr. (normal tankage); vertical rate-of-climb at sea-level in I.S.A. conditions at 5,000 lb. all-up weight, 600 ft./min.; hovering ceiling in free air in I.S.A. conditions, 10,000 ft.



ENGINE OUTSIDE.—External mounting of its uncowled Blackburn A.129 engine simplifies maintenance of the Wasp.

The Fighting Services

Air Rank Appointments

AIR COMMODORE T. B. DE LA P. BERESFORD, D.S.O., D.F.C., who has been Air Commodore, Operations, at Headquarters, Fighter Command, since April of last year, has become Senior Air Staff Officer, British Forces Arabian Peninsula. He has been succeeded at Fighter Command by Gp. Capt. E. J. Morris, C.B.E., D.S.O., D.F.C.

Appointed C.O. of No 233 Operational Conversion Unit at R.A.F. Pembrey in 1952, Air Cdre. Beresford became Air Adviser to the U.K. Commissioner in India in 1954. Gp. Capt. Morris, who has taken up his new post with the acting rank of Air Cdre., commanded R.A.F. Wattisham since May, 1958, before which he was Senior Air Staff Officer at No. 12 Group, Fighter Command.

Gp. Capt. P. Burnett, D.S.O., D.F.C., has been appointed Director of Intelligence (B) at the Air Ministry, with the acting rank of Air Cdre. Until recently Deputy Director of Intelligence 2 at the Air Ministry, he commanded the Officer Cadet Training Unit at R.A.F. Jurby between 1954 and 1957.

The Assistant Deputy Chief of Staff (Plans) at Headquarters, Allied Air Forces Mediterranean at Malta since May, 1957, Gp. Capt. W. I. C. Inness, O.B.E., has become Air Officer in charge of Administration at Headquarters, Coastal Command. Appointed to his new post with the acting rank of Air Cdre., he commanded R.A.F. St. Eval from 1955 to 1957.

To Command R.A.A.F. Butterworth

AIR COMMODORE G. C. HARTNELL, C.B.E., R.A.A.F., is to succeed Air Cdre. K. R. J. Parsons, D.S.O., D.F.C., A.F.C., R.A.A.F., as commander of the Australian base at Butterworth, Malaya. Air Cdre. Hartnell, who was Senior Air Staff Officer at the headquarters of the Australian Home Command between 1956 and 1958, is at present completing the Imperial Defence College course.

The original commander of No. 77 Squadron, R.A.A.F., in Korea, Wg. Cdr. J. W. Hubble, D.S.O., A.F.C., is to take over command of his old unit again at Butterworth. Having just completed the advanced flying course at the R.A.F. Flying College, Manby, he will succeed Sqn. Ldr. G. R. Harvey, D.F.C., who has been posted to the Joint Operations Centre at Kuala Lumpur.

Exercise "Dry Martini"

A FOUR-DAY joint R.A.F./Army airborne training exercise "Dry Martini" was mounted from R.A.F. Nicosia, Cyprus, on December 14. Taking place in Cyrenaica, the exercise included the 2nd Battalion, Parachute Regiment, based on Cyprus and elements of the 16th Parachute Brigade flown from the United Kingdom by Transport Command Beverleys and Hastings.

Carried by these transports and Hastings of No. 70 Squadron, Middle East Air Force, from Nicosia, the troops were parachuted into a dropping zone near the Wartime airfield of Derna on the Libyan coast shortly after first flight. Their objective was the airfield, which was defended by various ground units including No. 1 (Field) Squadron, R.A.F. Regiment, from El Adem.

Air support for the Parachute Battalion Group was provided by Hunters of No. 19 Squadron from El Adem, while M.E.A.F. Sycamores and Pembrokes operated in the "casevac" rôle. The Commander-in-Chief, M.E.A.F., Air Marshal Sir William MacDonald, watched the drops from a No. 36 Squadron Hastings.

DAY RETURN.—Piloting a Sea Vixen FAW. 1, the C.O. of No. 892 Squadron, Cdr. M. Petrie, R.N. (right), seen with his observer, Lieut. R. D. McCulloch, R.N., recently took-off from R.N.A.S. Yeovilton at 10.03 hrs. and landed on H.M.S. "Victorious" in the Mediterranean between Marseilles and Malta at 11.33 hrs. The two officers took-off again at 13.12 hrs. and landed back at Yeovilton at 14.37 hrs.

BRITANNIA BUILD-UP.—No. 511 Squadron was re-formed at R.A.F. Lyneham last month as the second Transport Command Britannia squadron. The Squadron Commander, Wg. Cdr. A. W. G. Le Hardy, is here speaking at a ceremony held at the Station on December 14 when the Squadron's original badge was presented by Air Chief Marshal Sir Frederick Bowhill and Mr. Peter Masefield handed over the documents of its first Bristol Britannia.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Wg. Cdr. J. T. Morris to the Department of the Air Member for Supply and Organization.

Bomber Command: Sqn. Ldr. N. O. S. Bayley, D.F.C., to R.A.F. Coningsby to command No. 9 Squadron, with acting rank of Wg. Cdr.

Fighter Command: Gp. Capt. E. Plumtree, O.B.E., D.F.C., to R.A.F. Leuchars to command; Wg. Cdr. J. E. Kilduff to the Central Fighter Establishment for operations duties; Wg. Cdr. M. C. Raban, A.F.C., to Headquarters for organization duties.

Transport Command: Wg. Cdr. A. W. G. Le Hardy, O.B.E., to R.A.F. Lyneham to command No. 511 Squadron.

Flying Training Command: Wg. Cdr. C. E. Beer, O.B.E., to Headquarters for equipment duties.

Technical Training Command: Gp. Capt. E. B. Harvey to the R.A.F. Rehabilitation Unit, Headley Court, to command.

Maintenance Command: Wg. Cdr. E. J. Brandon to No. 16 Maintenance Unit, Stafford, as Senior Technical Officer; Wg. Cdr. I. H. Mercer to R.A.F. Boscombe Down for medical duties.

Middle East Air Force: Gp. Capt. R. H. C. Brousson, O.B.E., to Headquarters as Command Engineering Officer; Wg. Cdr. F. W. Dewell, A.F.C., to Headquarters as Command Air Traffic Control Officer; Wg. Cdr. K. Bazarnik, A.F.C., to R.A.F. El Adem for medical duties.

Far East Air Force: Wg. Cdr. N. B. Freeman, A.F.C., to R.A.F. Changi to command the Flying Wing.

British Forces Arabian Peninsula: Wg. Cdr. J. A. Cooney to the Aden Protectorate Levies Hospital, Aden, to Command.

Other Appointments: Wg. Cdr. F. F. Fulton, O.B.E., to the staff of the Air Commander, Home Defence Forces, with acting rank of Gp. Capt.

More Service News

R.A.F. Rugger President.—Air Marshal Sir Kenneth Cross, A.O.C.-in-C., Bomber Command, has succeeded Marshal of the R.A.F. Sir Dermot Boyle as President of the R.A.F. Rugby Union. Air Marshal Sir Kenneth Cross represented the R.A.F. in pre-war inter-Service matches.

Sword Presentation.—The Worshipful Company of Goldsmiths has presented a ceremonial sword to the Chief of Air Staff, Marshal of the R.A.F. Sir Dermot Boyle. Similar in shape to a rapier, the sword has an enamelled golden globe pommel representing the World and a V-shaped motif on the knuckle guard and scabbard suggesting flight. To be worn on parade, its blade will be etched with the name of each succeeding C.A.S.

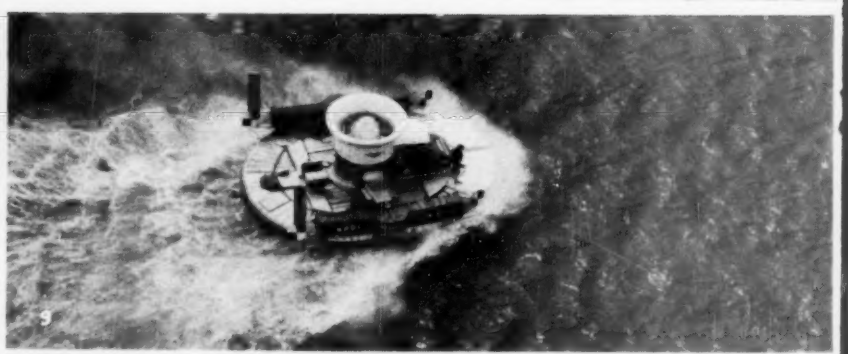
(1).—One of the Service aviation events of last year was the commissioning of the first operational Sea Vixen squadron by the Royal Navy.

(2).—Towards the end of the year came the announcement of an order from Australia for Bristol/Ferranti Bloodhound surface-to-air missiles for the R.A.A.F.

Highlights

(5).—News came in January that the Avon-powered English Electric Lightning had achieved a speed of Mach 2 in level flight.

(8).—An important personal flying event last year was the Duke of Edinburgh's solo flight in a Turbulent from White Waltham in October.



(9).—One of the principal technological highlights during the past twelve months was the debut of the remarkable N.R.D.C./Saro Hovercraft powered by a Leonides radial engine.

(10).—In the summer from Russia came the Tu-114 to dominate the Paris Aero Show scene. Later, two return flights were made between Moscow and New York.

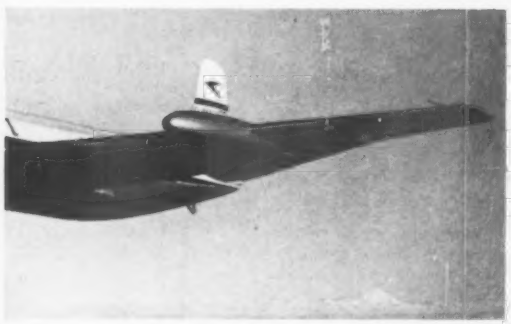
(11).—In October, less than a month after the Russians had crash-landed Lunik II on the Moon, they sent Lunik III (pictured here) on a photographic mission around the Moon, securing the first pictures of the hidden side.

(3).—In January, Fairey's noteworthy Eland-powered Rotodyne VTOL airliner prototype established a 100-km. closed-circuit record of 190.9 m.p.h.

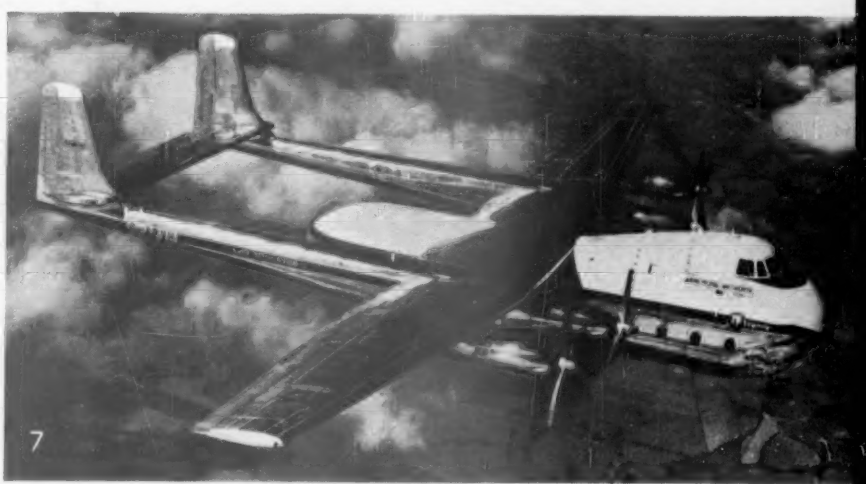
(4).—Helicopters played a major part in the *Daily Mail* "Arch to Arc" race; this floating platform was on the Thames near Battersea.

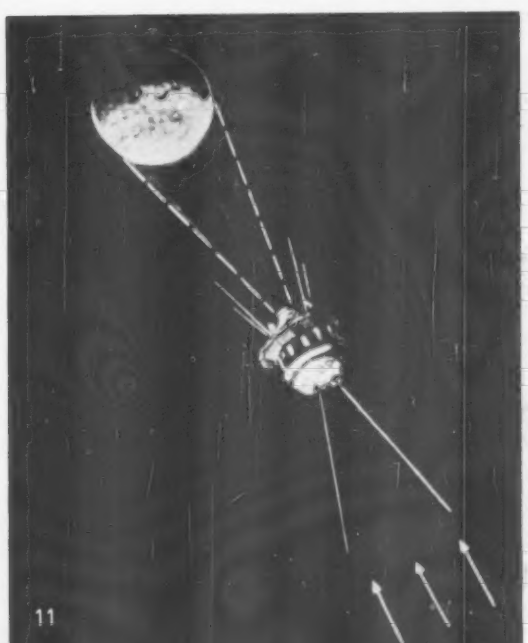
(7).—First flight of the AWA 650 Argosy, which has four Dart powerplants, came early in the year.

# of 1959



(6).—Last year saw the completion of 12 months of regular jet airliner services over the north Atlantic. B.O.A.C. and the Comet held the distinction of being first in this field.



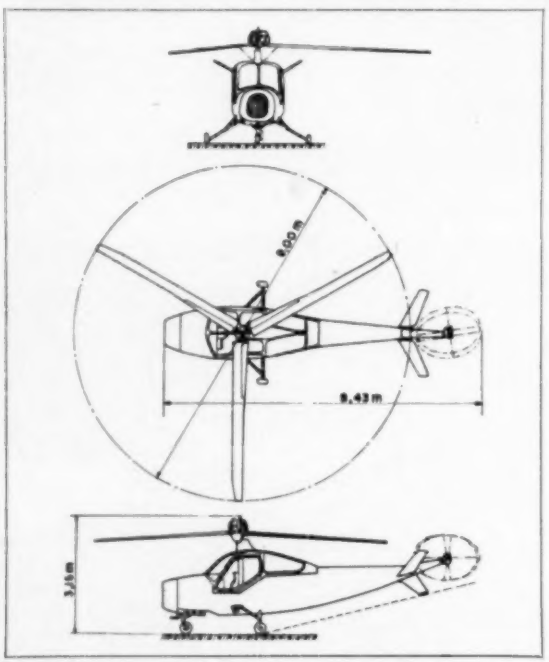


(12).—Another important civil aviation event in 1959 was the first flight of the Vickers-Armstrongs Vanguard—the first of the second-generation turboprop airliners—with Rolls-Royce Tynes.

Progress with German Helicopters

A brief survey of rotary-wing developments in West Germany.

So many German designers and engineers went abroad, or were taken abroad, after the War and kept up to date in foreign lands that it would not be surprising, now that they or their designs are returning home, to find well-developed ideas behind the new German aircraft. On the other hand, when abroad they often had to work under special difficulties, for example in the case of Kurt Tank in the Argentine, who apparently left when Peron went; and the Focke-inspired Beija-Flor helicopter built in Brazil using some motor vehicle parts.



The Beija-Flor helicopter, designed by Prof. E. H. Focke in Brazil before he returned to Germany and designed the Borgward.

This helicopter, which was not completed before Focke returned to Germany, is apparently quite Sikorsky-like in layout; but this is deceptive. For instance there are two tail rotors at 45° and intermeshing. By suitable pitch changes they are used for rudder and elevator and, of course, torque balancing.

The main rotor has flapping hinges but no drag hinges. Instead, the blades are braced in the rotor plane and in such a way that the faired bracing acts like a leading-edge slat, giving high lift qualities to the inner slow-moving parts of the blades.

As for the drive, the unavailability of high-grade industrial organizations capable of making prototype high-quality machinery, led to the use of an American engine (Continental E225) in front and below as in a motorcar and driving through a David Brown lorry worm drive giving a reduction of 1 : 8.4 in one stage. This has proved dependable, but of course it is heavy and current developments are planned to improve the payload.

The main characteristics of the Beija-Flor are: Rotor diameter, 9 m. (29 ft. 6 in.); disc area, 64 m.² (689 sq. ft.); length (overall), 8.8 m. (28 ft. 10 in.); height, 3.1 m. (10 ft. 2 in.). Its equipped weight is 750 kg. (1,654 lb.); disposable load is 300 kg. (661 lb.); and all-up weight, 1,050 kg. (2,315 lb.). Maximum speed is 150 km.p.h. (93 m.p.h.); economic cruising speed, 130 km.p.h. (81 m.p.h.).

In Germany itself we find the Merckle SM67 five-seater helicopter of quite normal layout. This has been developed to the order of the Federal Defence Ministry.

There is apparently nothing unusual in this helicopter. Like other single-turbine helicopters the engine (originally a 396-e.h.p. Artouste II B) sits on an open shelf aft of the main rotor. A normal tail rotor with a horizontal axis is used.

The only features of interest so far as the rotor is concerned are that the blade structure is bonded light alloy and that the flapping and drag hinges are located considerably outboard of the rotor axis. This is claimed to have a favourable effect on the dynamic stability. When the rotor is at rest the blades are supported by centrifugally controlled stops to give the blades acceptable ground clearance.

There is one yaw friction damper for all three blades which damps inter-blade oscillations and blade rotor-head oscillations.

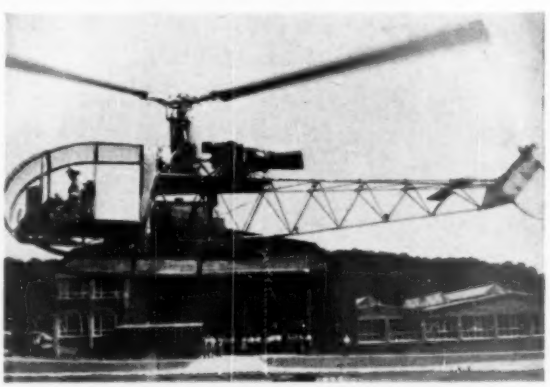
The first prototype of the Merckle suffered an accident and was severely damaged during ground tests in August. Another is, however, being built with certain modifications incorporated; it will be powered by a 396-e.h.p. Artouste for initial tests and later by a 493-e.h.p. version. There has been no news recently of this second craft and no announcement has been made about production plans. The main characteristics of the SM-67 are: Rotor diameter, 10.5 m. (34 ft. 5 in.); disc area, 86.59 m.² (932 sq. ft.); length, 10.02 m. (33 ft.); height, 2.8 m. (9 ft. 2 in.).

After Prof. Focke had returned to Germany from Brazil, he designed the Borgward helicopter—a three-seater intended as a general-purpose craft. This is powered by a 260-b.h.p. Lycoming flat-six engine and is larger and heavier than his Brazilian design. It is similar, however, in having the Vee tail-rotor layout employed for the Beija-Flor; but it differs in that its powerplant is located in the fuselage centre section under the rotor instead of in the nose ahead of the cockpit.

Data given for the Borgward—which has been named the Kolibri—are: rotor diameter, 30 ft. 10 in.; fuselage length, 27 ft. 3 in.; height, 10 ft.; disc area, 753 sq. ft. Its empty weight is given as 1,765 lb., with a normal take-off weight of 2,645 lb. Cruising speed is 87 m.p.h.

Another rotary-wing craft from Germany is the little Bölkow which was on show at the Paris Salon last June. This is a single-seater with a single-bladed counterbalanced rotor powered by a 50-h.p. two-stroke engine. Its rotor diameter is 21 ft. 7 in. and its normal take-off weight 882 lb. Precise performance data are, as yet, not available but the estimated cruising speed has been given as 71 m.p.h.

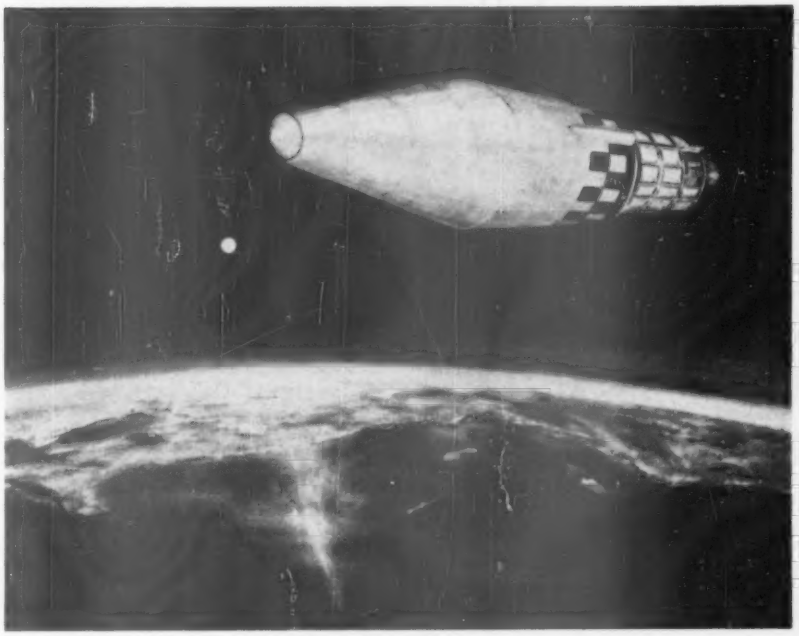
Quite clearly, helicopter development in Germany is not being overlooked; the three aircraft mentioned show the lines on which progress is being made. Other designs for even more ambitious projects may well be under consideration.



The prototype Merckle helicopter airborne. It was subsequently damaged during ground-running tests and a second prototype is being built.

Astronautics and Missiles

Lockheed Discoverer Project



Artist's impression of a Discoverer satellite in orbit. Prior to ejecting the re-entry capsule, the entire satellite is angled nose-down at 60° and the capsule is fired away by means of a small solid-propellent rocket.

"ANOTHER attempt to recover a capsule from a satellite has failed. The Defense Department announced tonight that a capsule was ejected from the orbiting Discoverer satellite, but that no signals were received from it afterwards." Thus runs a familiar commentary.

What exactly has happened in this programme, which the Americans regard as vital in their plan to put a man into space by 1962, is not entirely known, but at least there are some rather significant clues. Table 1 gives the history of the Discoverer launchings to date at Vandenberg AFB.

At the time of writing, eight satellites have been launched. Two did not enter orbit because they lacked sufficient speed. Seven of the eight vehicles carried capsules which were intended to be recovered by parachute after being ejected from the satellite; but none was in fact recovered.

Despite this, the programme is far from being a total loss and, in fact, a great deal has been learnt from each successive firing. On the whole, the launching system has shown a high standard of reliability, especially the first-stage Thor which is virtually a standard IRBM modified to accommodate the Hustler powerplant and satellite payload as the second stage.

The entire second stage goes into orbit. And this vehicle includes a complex orientation system which keeps the satellite parallel with the Earth's surface and subsequently changes the attitude to a downward angle prior to capsule ejection.

Stability in orbit depends on an infra-red horizon scanner which looks out in front and scans for the horizon, sending signals to the guidance system to orient the satellite. The heart of this system is an inertial reference package, developed by the Dynamics Corporation of America, which brings into play an arrangement of helium gas jets, exhausting from the sides of the vehicle. These are also employed for stability during injection of the second stage into orbit. Once the Discoverer is circling the Earth, these tiny gas jets ensure that the vehicle turns at just the right angle as it orbits the globe to maintain the desired parallel attitude.

Temperature Problems

The main difficulties the Discoverer satellites have encountered appear to be related to temperature which, in some cases, has apparently dropped below the design level of the chemical batteries. To overcome this, Discoverers VII and VIII were provided with heaters and their battery capacity was doubled.

The official U.S.A.F. explanation of the failure of Discoverer VII, which did not stabilize, was that there seemed to have been a power failure of the electrical system designed to separate the capsule from the satellite and put the satellite in the correct position for ejection. Indeed, almost all the troubles involved

TABLE 1

History of ARPA Discoverer programme

Vehicle	Launch date	Orbit—Miles		Capsule	Notes
		Perigee	Apogee		
Discoverer I ..	February 28, 1959 ..	99	605	None	First satellite to achieve polar orbit. Purpose of launching to test Thor-Hustler propulsion, staging, guidance and communication. Radio transmitter failed—only intermittent signals received.
Discoverer II ..	April 13, 1959 ..	142	220	Hemispherical 27 in. long × 33-in. base dia.; wt. 195 lb.	Capsule designed to maintain temperature and oxygen sufficient to sustain life; carried emulsion packs for radiation studies. Timer ejected capsule on April 14, but not recovered.
Discoverer III ..	June 3, 1959 ..	Failed to orbit (lacked sufficient speed)		As above	Capsule contained four black mice.
Discoverer IV ..	June 25, 1959 ..	Failed to orbit (lacked sufficient speed)		Wt. 300 lb.	Test of capsule separation and recovery; no scientific research payload.
Discoverer V ..	August 13, 1959 ..	136	450	Wt. 300 lb.	Test of capsule separation and recovery. Capsule ejected but not recovered.
Discoverer VI ..	August 19, 1959 ..	139	537	Wt. 300 lb.	Test of capsule separation and recovery. Capsule ejected but not recovered. No tracking signals received after ejection.
Discoverer VII ..	November 7, 1959 ..	104	550	Wt. 300 lb.	Test of capsule separation and recovery. Provision for heating satellite equipment. Satellite did not stabilize and capsule failed to eject.
Discoverer VIII ..	November 20, 1959	"Highly eccentric orbit."		Wt. 300 lb.	Test of capsule separation and recovery. Satellite weatherproofed against temperature extremes. Capsule ejected but not recovered.

Four black mice were aboard Discoverer III which failed to go into orbit on June 3, 1959. Here Lockheed technicians are seen placing the "environment compartment" inside the re-entry capsule designed to bring it back from orbit.

in the Discoverer satellites which successfully went into orbit seem to have been due, in some way, to low temperatures and electrical failures.

Those capsules that did separate were not located because—it is said—their radio beacons failed. How they fared during re-entry is not known, but development of the capsules has continued to ensure their integrity under severe atmospheric heating.

Ablating Heat Shield

Later Discoverer capsules have been fitted with heat shields of the ablating type, in which the frictional heat of re-entry is dissipated by melting and vaporizing material on the surface of the shield. Similar heat shields are now being developed for the Mercury space-capsule designed to recover a man from orbit, which are understood to consist of several layers of polyester resin-glass fibre over a nickel cobalt skin.

Much of the Discoverer programme is, in fact, aimed at developing techniques for the Mercury "man-in-space" project. For example, the recovery system is designed to function in an air-and-water environment for 10 hours after the capsule has been ejected from orbit.

Principal components of the recovery system are batteries for electrical power, a parachute for reducing speed during descent, a radio marker beacon for ground tracking, and a strobe light for visual location of the descending capsule. The light is designed to flash 30 to 45 times a minute, the duration of each flash lasting from 30 to 50 microseconds; it can be seen in darkness for a distance of four to six miles at altitudes of 8,000 to 10,000 ft.

One of the virtues of Discoverer's orientation system is that the complete orbiting vehicle can be turned through 180° to a tail-first position and tilted to a downward angle of 60° for capsule ejection.

After separating from the satellite, the capsule's recovery system is put into operation automatically. First, a mechanical timer is actuated to operate a deceleration switch. This brings about ejection of the thermal protection cover for the parachute compartment at the proper time, followed by deployment of the brightly coloured recovery parachute.

The strobe light and radio beacon are both powered by a mercury battery. The beacon's antenna—made of flexible metal tape—is 13½ in. long.

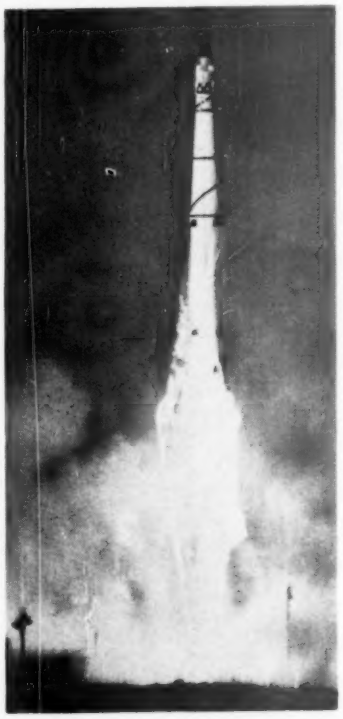
Present arrangements are to attempt ejection of the capsule on the satellite's 17th orbit when, if all goes well, re-entry will be made over an area of ocean 50 miles wide and 200 miles long near Hawaii. In this region, a number of C-119 transport aircraft trailing nets will attempt to snare the capsule as it drifts down beneath its parachute. If they fail, ships will be waiting to try and recover the capsule from the sea.

Despite the lack of success in capsule recovery, the Discoverer has nevertheless achieved several important objectives. It was the first satellite to be sent into orbit (from Vandenberg) over the poles and, because of its horizon scanner and its response to ground signals, it is probably the only vehicle of its kind capable of being placed in a precise, predictable, orbit.

It is certainly unique in its ability of being turned tail-first in orbit and tilted downward for capsule ejection. Nevertheless, the Moon-circling Lunik III showed that the Russians are becoming adept in similar orientation techniques.

What of the future? Present indications are that more than 20 additional launchings will be made from Vandenberg, and the frequency of launching is expected to reach two per month early this year. The continuing importance of the programme was emphasized by an Air Force spokesman of the Hawaii base whose aircraft had searched in vain for the capsule from Discoverer VIII:—

"Recovery from orbit has never been accomplished by us or Russia," he said. "Until we can establish the technique, we will never send a man into orbit because we have to be sure we can get him back."



Discoverer VI "blasts off" from Vandenberg Air Force Base on August 19, 1959. Although a successful orbit was achieved, and the capsule separated as planned, it was not recovered.

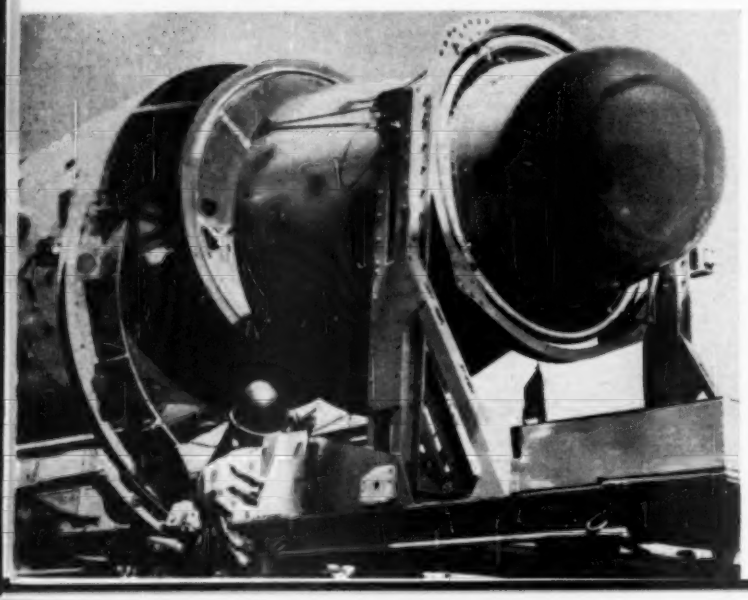
TECHNICAL DATA

LAUNCHING VEHICLE.—Standard Douglas Thor SM-75A, modified to accommodate Bell Hustler (Agena) as second stage. Overall height, both stages, 75.9 ft.

FIRST STAGE.—Launch weight 100,000 lb. plus; nominal s.t. 150,000 lb.; height 66.7 ft. (with adapter skirt).

SECOND STAGE.—Launch weight 8,400 lb.; orbital weight (tanks dry) 1,700 lb., including 300-lb. re-entry capsule; nominal s.t. 15,000 lb.

Note:—In addition to the re-entry capsule, the Agena payload includes 40 lb. of telemetry equipment of advanced design in circuitry and miniaturization. It will operate on 15 channels, 10 continuous and 5 commuted, which can relay continuously about 100 items of information on the performance of the vehicle and its systems.—K.W.G.



Nose-cone of Discoverer III showing the life support and recovery capsule, with its fairing, being mated to the afterbody of the second-stage launching vehicle.

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Now—
another first!

THE SOLID
ROTOR
ALTERNATOR

* Eliminating brushes and rotating windings.
* Particularly suitable for high temperature and high speeds. Ideal for high mach number aircraft.
* Also supplied as a brushless d.c. generator without rotating winding. (A lighter machine than any other brushless d.c. generator.)
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CANADAIR'S ALL-NEW, ALL-CARGO "FORTY FOUR" SOARS SKYWARD

FIRST IN FLIGHT, FIRST IN PRODUCTION, FIRST FOR DELIVERY— THAT'S THE SUCCESS STORY OF CANADAIR'S NEW CARGOPLANE

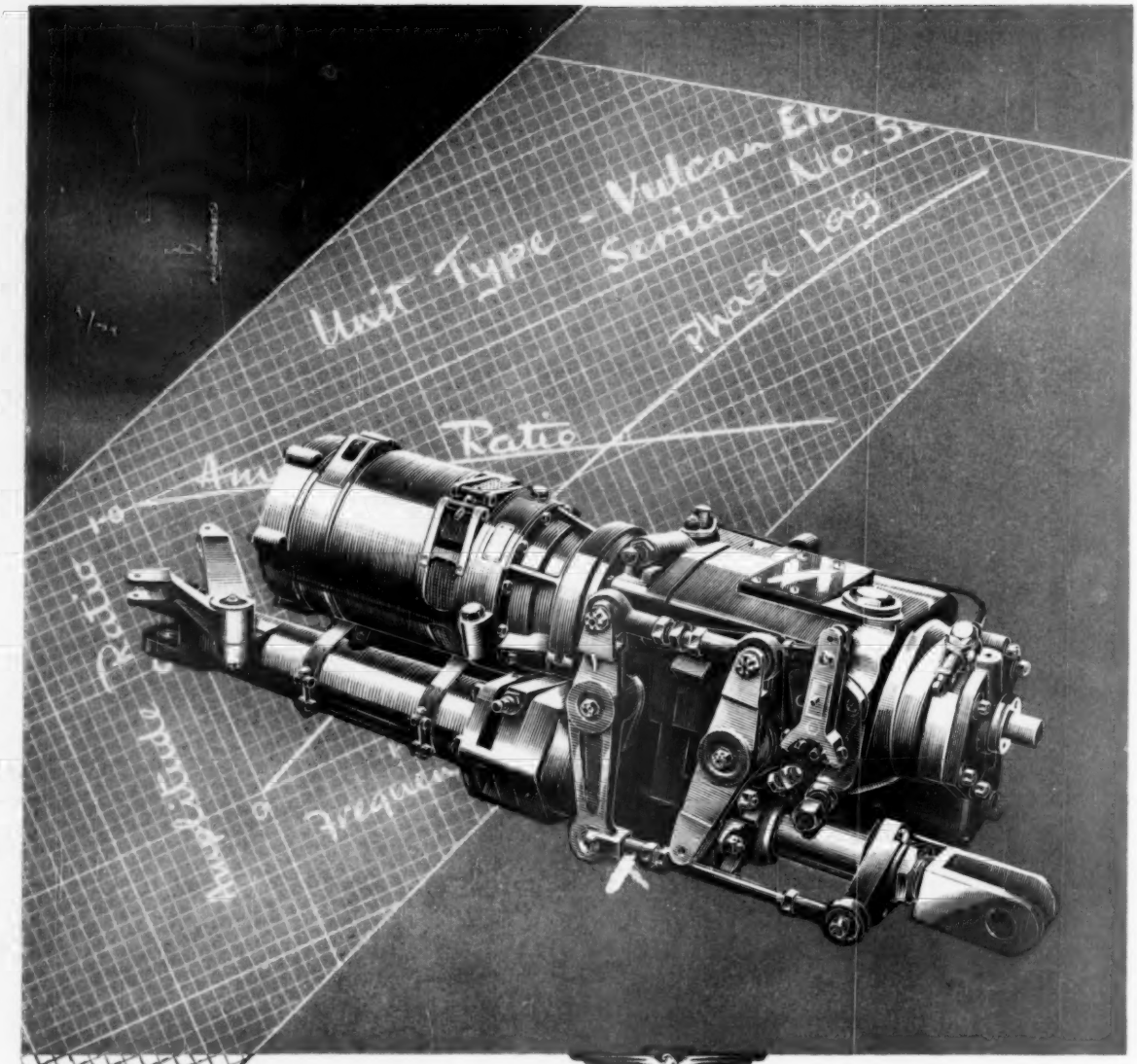
THERE ARE NO IFS, ANDS OR BUTS ABOUT THIS CARGOPLANE! It is here. It is built for use now. Its first flight marked a giant step forward in its development program. The next step will be its FAA type certification, and then the all-new Canadair Forty Four will go into regular air cargo service with The Flying Tiger Line, Seaboard & Western Airlines and the Royal Canadian Air Force.

THE RIGHT SIZE AT THE RIGHT TIME. The present payload capacity of the "Forty Four" is ideally matched to the forecasted cargo requirements of the 1960's. It is in the '60's that the development rate of air freight will climb sharply toward the major breakthrough in air cargo traffic. The Canadair Forty Four is the right size for highly profitable operations during this rising development period.

CANADAIR
LIMITED, MONTREAL, CANADIAN SUBSIDIARY OF

Canadair Forty Four, photographed in flight November 15, 1959

GENERAL DYNAMICS CORPORATION



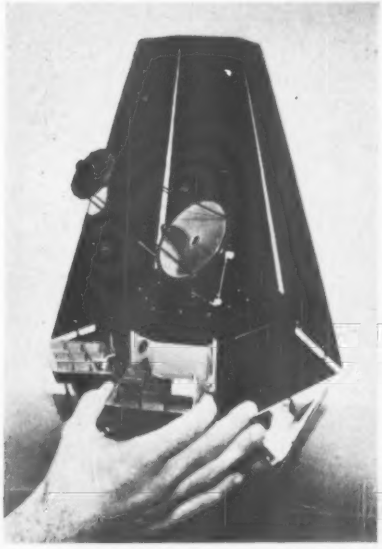
POWER CONTROLS

The "packaged" powered flying control illustrated operates the outboard elevons of the Avro Vulcan B. Mk. 2 aircraft. The extreme compactness of this self-contained unit is achieved by the embodiment of a swash-plate main pumping element, while pressurisation of the fluid in the unit sump prevents fluid starvation and ensures efficient operation at high altitudes.

BOULTON PAUL AIRCRAFT LTD.
WOLVERHAMPTON, ENGLAND

Missile and Space Projects

TARGET EYE.—Right, a miniature, self-contained, "TV station", designed by the U.S. Army to be carried by a ballistic missile and ejected during flight. While falling to Earth with the warhead, the camera would photograph the impact point of the missile, transmitting its view of the target area to TV monitoring screens located behind the battle line.

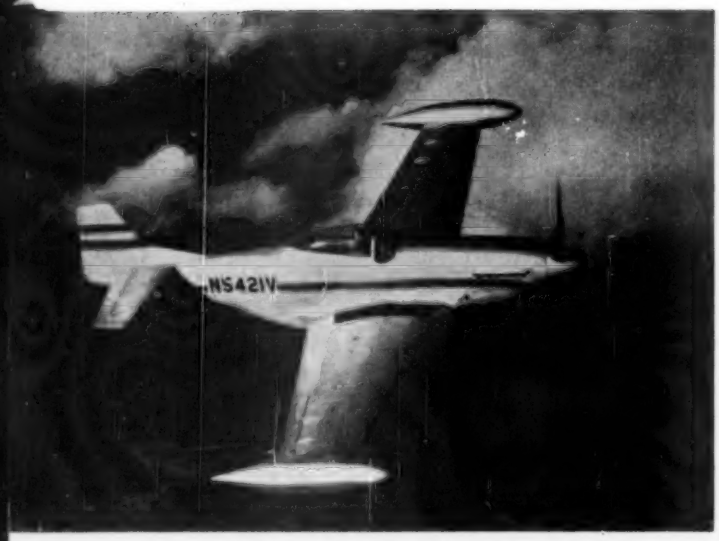


U.S. "ANTI".—Left, an early test model of the Nike Zeus leaps from the launching ramp during a test firing of the U.S. Army's anti-missile missile at White Sands, New Mexico.

MARS PROBE.—Above left, a one-sixth scale model of a proposed payload for a NASA interplanetary probe being developed at the Jet Propulsion Laboratory. Shown above the base is an infra-red spectrophotometer designed to point at Mars while the probe is in orbit. A telescopic mirror arrangement will collect light rays from the planet for analysis and transmission back to Earth.

TOP THRUST.—Above, a full size sectioned model of the 6,000-lb. s.t. "storable" rocket engine being developed by the Jet Propulsion Laboratory for the top stage of both the NASA Centaur and Saturn space-vehicles.

MOULDED COMFORT?—Left, a 40g "human support system" used in investigating problems encountered in developing the Mercury space-capsule at NASA's Langley Research Centre. Made of foam plastic, the couches are contoured to suit the person using the support system. After hardening, the form is finished with a fibre material and the couch is then locked into a metal container.



EXECUTIVE MUSTANG.—Civilianized F-51D Mustang fighters are now being offered by Trans-Florida Aviation for high-speed executive operations. Two seats are fitted, and a tip-tank installation has been developed as shown in this photograph. The factory price is little more than £11,000.

Personal Flying

A little late for Christmas but nonetheless acceptable to the busy executive who has *everything*, the super de luxe civil F-51D Mustang is our nomination as the business aircraft of the year. From Frank Dismore, of W. S. Shackleton, Ltd., we hear that an American company (who else?), Trans-Florida Aviation, Inc., of Sarasota, Fla., is offering civilianized ex-U.S.A.F. and R.C.A.F. Mustangs for executives who were former Service pilots, or are equally experienced.

According to the U.S. company, they have "overcome many disadvantages of the military model, and you will find the cockpit noise greatly decreased to a pleasing level. The cabin cooling system has been greatly improved and the layout of instruments and controls cleaned up considerably. We provide custom instrumentation, radio of airline quality, upholstery and interior appointments and custom painting by experts in each field. Baggage compartments and an additional passenger seat have been added.

"The F-51D is probably still the favourite of anyone who has ever flown it. It has a low stalling speed (87 m.p.h. I.A.S.) and a broad gear base, handles like a heavy airplane, yet is beautifully light and responsive on the controls."

Its performance takes it above or around bad weather, and oxygen is provided for a 25,000-ft. cruising altitude. The company adds, "we regularly cruise between 300-400 m.p.h. ground speed, depending on power settings, and you can safely figure an average of 5-7 m.p.g." The F-51D is still in wide-scale service, and spares are readily available, while maintenance costs are claimed to be very low.

Initial price of the rebuilt Executive Mustang, at $32,500, f.a.f. Sarasota, compares surprisingly closely to many smaller single-engined business types, and includes Collins 90-channel transmitter, Bendix 280-channel crystal-controlled Omni, Interphone, and an ARN6 ADF with miniature control head, complete aerial system, Omni-Mag instrument presentation, OBI and RMI. All Executive Mustangs come equipped with the Safeflight speed control system at no extra cost.

The specially upholstered seat in the narrow cockpit hinges forward for access to the second seat, which is a new feature in the Executive Mustang. The ammunition and gun bays in the wings have been converted to carry eight specially made suitcases.

The 1,615 b.h.p. Packard Merlin V-1650-7 has a two-speed supercharger, and confers a maximum speed of 457 m.p.h. at 30,000 ft. Economical cruise is 260 m.p.h. at 10,000 ft., achieving 7.7 miles per U.S. gal. Normal wing tankage is 182 U.S. gal., which may be increased to 300 U.S. gal. with additional tip-tanks. Empty weight is 7,100 lb., and F.A.A.-approved gross is 10,500 lb. Take-off to 50 ft. is 1,800 ft. and landing distance 1,850 ft.

Frank Dismore concludes, "I wonder how many of your readers would like to fly the 'World's Fastest Certificated Non-transport Aircraft?'"

We should, for a start.

Gliding Notes

by Dr. A. E. Slater

AN Indian duration record of 8 hr. 14 min. prompted thoughts about Indian thermals, and the vultures which soar in them all day long with the greatest of ease. Much of the early speculation on soaring flight came from that country, in the days when nobody knew how it was done.

In particular, Dr. E. H. Hankin watched soaring vultures meticulously for years. He made thousands of entries in a series of note-books, and published a book called "Animal Flight" about 1911.

Yet he flatly refused to believe that they used upcurrents, except for a few obvious cases of slope-soaring over the battlements at Agra. When Eric Collins made the first British flights in "dry" thermals in 1933, Dr. Hankin wrote to him to find out, not how he did it, but whether he experienced the same forms of apparent instability that were shown by soaring vultures.

Mr. P. K. Banerjea, of the Delhi Gliding Club, has kindly replied to some questions about his record flight, which was made on September 30 in latitude 28½°N., so the duration of daylight must have been well under 12 hours. It appears that Indian thermals are not notably stronger than on a good soaring day in England. His first thermal, after a winch launch to 1,000 ft. at 09.52 hrs. in a Ka-7 sailplane, produced lift of only ½ m./sec.

But when the cumulus clouds began at 11.15 hrs., thermal lift improved to 3½ m./sec. on the average, increasing to 4 or 5 m./sec. below cloud base, which was at 4,300 ft. Then, at 13.00 hrs. he had to move 10 miles north to avoid a cu-nim forming over the airfield. He soared there happily under cumulus clouds, though thermal strength deteriorated to 1½ m./sec. after 14.00 hrs., and at 15.30 the cumulus began to disappear.

However, by this time the cu-nim had cleared, so he returned to the airfield, where fresh cumulus clouds were starting up, and their bases rose from 4,900 to 5,600 ft. as the ground below dried out in the sun. However, lift deteriorated to less than 1 m./sec.

* * *

So the main advantage of Indian over British thermals, it appears, is not their strength, but their frequency and their closer spacing. Mr. Banerjea puts their average distance apart at about a third of a mile, except early or late in the day.

Perhaps the most remarkable feature of his flight was towards the end, when all the clouds had gone by 16.30 hrs. except for "a solitary bank of flat cumulus with a very sharply defined base," seven miles to the south. Those familiar with Delhi might know of some feature of the landscape which could account for it.

This late cloud gave lift at ½ m./sec. at 2,000 ft., increasing to 2½ m./sec. close under its base, which was at 6,000 ft.—Mr. Banerjea's greatest height (he had no blind-flying instruments). This was at 17.15 hrs., but ten minutes later the cloud began breaking up.

Sunset was at 17.55, but his final glide down lasted till 18.06. This is the only time I have ever heard of a thermal flight ending after sunset.

Vultures, Mr. Banerjea says, are a great boon to sailplane pilots in search of lift, for there may be anything up to a hundred in one thermal. But they evidently don't observe the rule that everyone should circle the same way round, for there have been several collisions, though the human pilots have, so far, always brought the damaged glider down safely.

Vultures avoid a collision by closing their wings and diving, but kites usually pull up into a stall. So you must be good at "aircraft" recognition to take proper avoiding action, and pull up for a vulture, but dive for a kite.

* * *

TWO National Gliding Weeks will be held in 1960. For the first, from May 28 to June 6 inclusive, contests will be organized by the Cornish Gliding Club at Perranporth, the Lakes Club at Tebay, and the Scottish Gliding Union at Kinross. The second is from July 24 to August 1, to be run by the Yorkshire Club at Sutton Bank, the London Club at Dunstable, and the Derbyshire and Lancashire Club at Camphill.

The "National Gliding Week" scheme began in 1958 with contests simultaneously at the Scottish, Bristol and London Clubs, and 71 pilots took part. The idea was to provide a substitute for the centralized national championships which are not held in World Championship years.

Correspondence

Permission Issued

YOUR report of the Tiger Club dinner mentions the interesting fact that a speaker lamented the "non-issue" of a Permit to Fly for the Taylor monoplane. The facts available to the speaker before the dinner make his motives in making such a statement difficult to understand.

This exceptional little aeroplane is the first all-British amateur designed and built ultra-light to fly since the War and as such has merited a great deal of attention from all who are enthusiastic in the cause of amateur building and flying.

As a prototype, it has needed to be submitted to both structural investigation and flight testing to qualify for a full Permit to Fly. In order to qualify, a test Permit was issued within a few hours of application being made, and the 15 hours' local flying prescribed has been carried out with entire satisfaction—being the subject of probably one of the most eulogistic flight test records ever produced.

A programme of simple proof loading of certain items of structure is currently in train, the progress of which is governed by the pace set by the designer who, as an amateur, has his bread to earn and little spare time to carry out the necessary work. The equally spare-time enthusiasts of the P.F.A. who donate their technical skill to help fellow amateurs have given freely of their time, and, one might add, at no expense to the constructor.

The fact that the aircraft has apparently carried out some 20-odd hours over the test schedule seems to indicate that time spent on local flying on the test permit has seemed preferable to utilizing this period to clearing the small amount of structural testing necessary to permit the aircraft to leave the circuit. This has no doubt been fun for the pilot, but, of course, delays the eventual aim of all concerned, which is to get the aircraft cleared and its owner-constructor airborne on his own wings to roam in the remaining free air space.

Popular Flying Association, London, W.1. H. BEST-DEVEREUX.

Fear of Collision in the Air

HAVING read some of the letters in your column which my article, "Fear of Collision" (THE AEROPLANE AND ASTRONAUTICS, November 20) evoked, I once again read my own article, and I was forced to the conclusion that either some of your correspondents could not have read it very carefully, or I had not made myself clear. If you will forgive the personal note, I would like to correct the impression which seems to have been created that I am a reckless young pilot, anxious to break my own neck and anybody else's at the same time. This is far from the truth.

My age is 54, and five years ago my wife and I celebrated our Silver Wedding Anniversary. We have four children and two grandchildren. I am the director of a large family business which next year celebrates its 150th anniversary; I have been a member of local councils, a governor of schools, and chairman of our local flower show. I give you these facts in the hopes of proving that what I said was not based on recklessness, but on sheer common sense.

I admit I love flying small aeroplanes. I use them for business because I find flying much less nerve-racking than motoring, and a safer way of getting about the countryside. There is any amount of room in the sky, and I suggest, in all seriousness, that if it had not been for the short-sightedness of our aviation firms and the stupidity of our Ministries, some aviation firm in this country might well have been celebrating the delivery of its 50,000th small aeroplane as Pipers in America did a short while ago.

When I was a young man, we made in this country the best light aircraft in the World. The World future for light aircraft is tremendous, not so much in the U.K., or even in America or Europe, but in countries such as China, India and Africa where communications are not good and rivers and forests abound. For the time being we have lost this market, but we have the facilities to get it back. We have the skill to make the craft, but my quite extensive business training has taught me that you must have a lively home market before you can export. The only way in which we can get this lively home market is to clear away these misconceptions which (as I said in my article) have risen from fear.

If we approach this question of air traffic control in a common-sense, "live and let live," spirit, we can keep the risk of collision at the infinitesimal chance that it is today. There is risk in whatever you do.

It is a pity, but of course quite natural, that the people who run air charter and scheduled services are not anxious to see a lot of private aeroplanes in the sky anywhere in the World, but I do appeal to them to take a larger view of their duty towards their country. Private aeroplanes will come whether they like it or not; and the choice is ours as to whether a good percentage of the machines are British made, whether we are to have a thriving aviation industry in this country, or whether the aviation interest of this country is to be confined to a few Government-owned air lines and ballistic missiles.

The ability to fly is a God-sent gift. The air is free and very roomy. We should use it as it was intended to be used.

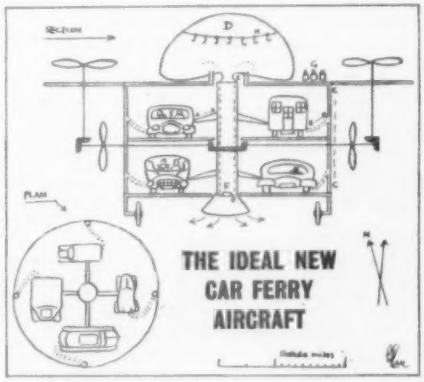
Claygate, Surrey. NORMAN JONES.

Aroundabout

Seasonal Aviation and Astronautics

*

Do It Yourself. I hope I'm not infringing any patents by printing this bit of festive fun put out by Silver City. The drawing, by Mr. L. Clare, one of their Lydd staff, shows his idea of a do-it-yourself car-ferry aircraft, combining the principles of lighter-than-air helicopter and hovercraft. The customers sit in their cars which are attached to capstan bars A-A, and drive round and round, rotating the cylinder E-E which actuates the rotors and directional propellers.



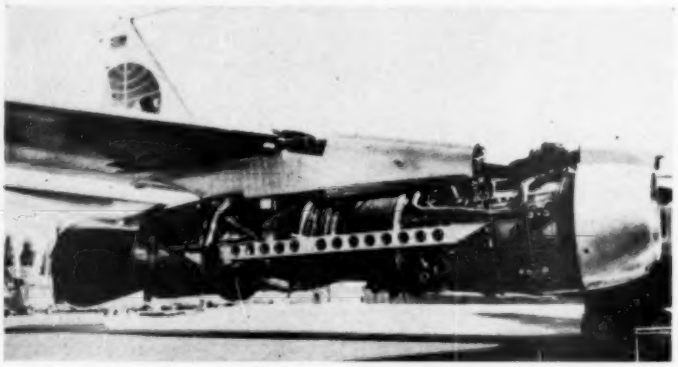
The car exhaust gases travel through B-B and C-C into the envelope D, providing lift and, through valve F, a hover-cushion. The downward jet effect can be accelerated by hanging the weights G on the hooks H. Mr. Clare claims that his idea will make all aircrew, engineer and airport staffs redundant. Silver City, too, if they're not careful.

*

"Never mind about the damn prototype—why weren't the plastic model kits ready before Christmas?"

by Goren

NOTES AND EVENTS



LESS NOISE.—A universal type UDAC ground jet noise suppressor developed by Industrial Acoustics Company of New York installed on a P.A.A. Boeing 707 engine. The equipment has been designed for use with the 707s and DC-8s, and will soon be adaptable to the Convair 880 and 600 series.

G.E.C. FOR YUGOSLAVIA.—The Yugoslav purchasing commission which recently visited Britain has signed a contract with G.E.C. Overseas Services, Ltd., for the supply of airport lighting equipment valued at about £75,000, to be installed at airports at Belgrade and Zagreb.

R.R.A.F. ARGONAUTS.—The Royal Rhodesian Air Force has purchased four Canadair Argonauts from B.O.A.C. The first left London Airport for Africa on December 14, after being accepted by Air Vice-Marshal E. W. S. Jacklin, C.A.S. of the R.R.A.F.

BEAVER ORDER.—The Army Air Corps has confirmed an order for a total of 36 Beavers from D.H. Canada. The first can be delivered from existing stocks within 90 days.

NEW DIRECTOR.—Mr. B. P. Yates has recently been appointed to the board of directors of Low Moor Alloy Steelworks, Ltd. Mr. Yates has for many years been secretary of the company and its associate companies, Yorkshire Rolling Mills, Ltd., and Low Moor Fine Steels, Ltd.

A NEW REPORT.—The Institution of Production Engineers has published a report entitled "Improved Material Utilization." This work has been undertaken in response to the widespread interest aroused in industry by the publication, in 1959, of a report on "Material Utilization in the Metal Working Industries." The new publication includes a selection of over 80 proved case studies. Copies of the report may be obtained from the publications department of the Institution, 10 Chesterfield Street, Mayfair, W.1, price 12s. 6d. each, post and packing 1s.

CHANGE OF OWNERSHIP.—The Timken Roller Bearing Co., and The Fafnir Bearing Co., of New Britain, Connecticut, U.S.A., have announced that an agreement will shortly be concluded by which a recently formed subsidiary of the latter, Fafnir Bearing Co., Ltd., will purchase the business of Fischer Bearing Co., Ltd., a Timken subsidiary. The sale of Fischer, which was until recently owned by the former British Timken, Ltd., results from the Timken decision to confine their interest to the manufacture of tapered roller bearings throughout the World. They will, however, continue for the present to distribute F.B.C. bearings for replacement purposes in Britain, through their subsidiary Timken stockists, and in Australia, South Africa and Canada, through their branches in those countries.

METALLIZING HANDBOOK. — A booklet covering the techniques and developments in flame spraying has been published by the Metallizing Equipment Co., Ltd., Chobham, Woking. The book, which is intended for owners and operators of metallizing equipment, is divided into two parts. The first section is devoted to wire metal spraying and the second contains the latest information on the powder process.

NATO ORDER.—Two contracts totalling $700,000 for spare parts for American-built fighter bombers and reconnaissance aircraft have been awarded to Republic Aviation (International) S.A. by NATO maintenance supply services agency in Paris.

Company Notices

NEW COMPANIES

Doncaster and District Gliding Club, Ltd. (644,388).—Reg. December 14 as a company limited by guarantee without share capital. The original number of members is 500 each being liable for £1 in the event of winding up. The management is vested in a council first members of which are: James W. Coulsey, The Turbary, Epworth, nr. Doncaster; Horace J. Durdy, 17 Callander Court, Cantley, Doncaster; Samuel F. R. Bowman, Michael A. Mitchell, Peter D. Hardy, Henry Pashley, Herbert Moore and Michael C. Usherwood. Sec.: R. Plane. Reg. office: Doncaster Airport, Ellers Road, Doncaster.

John Brown (S.E.N.D.), Ltd. (644,437).—Private co. **Reg.** December 14. Cap. £1,000 in £1 shs. Objects: To carry on the business of consulting engineers and as consultants and as contractors and advisers on engineering matters, etc. First directors: Rt. Hon. Lord Aberconway, 25 Egerton Terrace, London, S.W.3.; Eric Mensforth, 8 Stumperlowe Hall Road, Fulwood, Sheffield, 10; Robert J. Barclay, Peacock Hotel, Baslow, Derbys.; Dennis R. C. Guttery, Little Hall, Oakley Green, nr. Windsor; John D. Markland, 31 Capel Close, Oxford. Sec.: James R. Smyth. Solrs.: Roney and Co., 42-5 New Broad Street, London, E.C.2. Reg. office: 4 The Sanctuary, Westminster, S.W.1.

Aviation Calendar

January 4.—R.Ae.S. Boscombe Down Branch lecture, "Escape from Military Jet Aircraft," by Wg. Cdr. J. Jewell, in the Lecture Hall, A. and A.E.E., **Amesbury**, Wilts, at 17.30 hrs.

January 4.—R.Ae.S. Derby Branch lecture, "The Use of Rockets in Scientific Research," by Prof. H. S. W. Massey, in the Rolls-Royce Welfare Hall, Nightingale Road, **Derby**, at 18.15 hrs.

January 5.—R.Ae.S. London Airport Branch lecture, "Helicopters," by P. Brooks, in the Lecture Hall, Fairey Aviation, **Hayes**, at 18.15 hrs.

January 5.—R.Ae.S. Luton Branch lecture, "No Highway," by C. F. Toms, in the Napier Senior Staff Canteen, **Luton Airport**, at 18.15 hrs.

January 6.—R.Ae.S. Brough Branch lecture, "The Art of Developing Aero Engines," by A. C. Lovesey, at the Royal Station Hotel, **Hull**, at 19.30 hrs.

January 6.—R.Ae.S. Weybridge Branch lecture, "The Work of Vickers Research, Ltd.," by Dr. J. R. Green, at the Apprentice Training School, Vickers-Armstrongs, **Weybridge**, at 18.10 hrs.

January 6.—R.Ae.S. Bristol Branch lecture, "The Satellite Programme," by Dr. W. F. Hilton, at Filton House, **Bristol**, at 18.00 hrs.

January 7.—R.Ae.S. Young People's lecture, "Flying versus the Human Machine," by Dr. G. Melvill Jones, at the Royal Society of Arts, 6 John Adam Street, **London**, W.C.2, at 15.00 hrs.

January 7.—Isle of Wight Branch lecture, "Philosophy in Structural Design," by Dr. A. H. Chilver, in the Clubhouse, Saunders-Roe Sports and Social Club, Church Path, **E. Cowes**, at 18.00 hrs.

January 7.—R.Ae.S. Yeovil Branch lecture, "Helicopter Test Flying," by W. H. Spear, at Park School, Park Road, **Yeovil**, at 19.30 hrs.

January 8.—Helic. Assn. of Gt. Britain lecture, "The Development and Flight Testing of Helicopters," by G. J. Sansted and A. V. Coles, in the Library, 4 Hamilton Place, **London**, W.1.

INCREASES OF CAPITAL

Clifton Aircraft Ltd. (374,189). West Cliffe, Lytham, Lancs.—Increased by £30,000, in £1 shs. beyond the reg. cap. of £20,000.

R.F.D. Company, Ltd. (318,058). 9 Clarges Street, W.1.—Increased by £100,000, in 2s. ordinary shs. beyond the reg. cap. of £600,000.

British Overseas Fairs, Ltd. (524,399). 21 Tothill Street, London, S.W.1.—Increased by £99,900, in £1 ordinary shs. beyond the reg. cap. of £100.

New Patents

APPLICATIONS ACCEPTED

825,134.—Licentia Patent-Verwaltungs G.m.b.H. Stabilizing fins for ships and aircraft. June 22, 1956. (June 24, 1955.)

Applications opened to public inspection on December 9, 1959, and the opposition period will expire on March 9, 1960.

827,125.—Brevets Aéro-Mecaniques S.A.—"Rockets carried in clusters by a launching machine and in particular an aircraft."—March 18, 1958. (March 27, 1957, and Aug. 27, 1957.)

827,299.—Pye, Ltd.—"Guided missiles." May 20, 1957. (June 26, 1956.)

Applications open to public inspection on February 3, 1960, and the opposition period will expire on May 3, 1960.

Personal Notices

BIRTHS

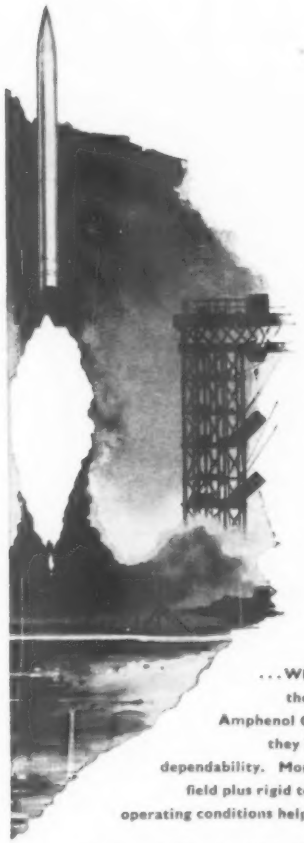
Anderson.—On December 18, at the R.A.F. Hospital, Nocton Hall, Lincoln, to Moyra (*née* Carr), wife of Flt. Lt. D. D. Anderson, R.A.F.—a daughter.

Barwood.—On December 17, at Westow Croft Maternity Home, to Elizabeth Ann (*née* Simpson), wife of Sqn. Ldr. A. T. Barwood, R.A.F.—a daughter.

Carter.—On December 14, at R.A.F. Hospital, Wegberg, Germany, to Jackie, wife of Sqn. Ldr. J. V. Carter, R.A.F.—a son.

Davies.—On December 13, at B.M.H. Taiping, to Jean (*née* Goate), wife of Flt. Lt. B. Davies, of R.A.F. Butterworth, Malaya—a son.

James.—On December 14, at Ards Hospital, Co. Down, to Mary (*née* Morrison), wife of Flt. Lt. B. James, R.A.F.—a daughter.



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. . . When maximum performance under the most exacting conditions is vital, Amphenol Connectors play the part for which they have been designed with complete dependability. More than 25 years' experience in this field plus rigid test requirements far beyond likely operating conditions help to ensure their sturdy reliability.

For example, Amphenol MinniE miniature multi-contact connectors are tested for altitude-moisture resistance by submersion in salt-water, and altitude cycling to 80,000 feet, to 65,000 feet and then returned to room ambient pressure.

Amphenol "MinniE" Connector

Quick disconnect, multi-contact, miniature bayonet lock types. Available as Plugs, Cable and Panel Receptacles and Single Hole mounting Receptacles in four constructions, five shell sizes and seventeen insert arrangements.

Amphenol "165 Series" Connector

Designed especially for use with the ARC52 equipment installed in the Vickers-Armstrongs "Scimitar", the English Electric "Lightning" and other military aircraft. Variants of this 42-contact connector are available to meet different requirements. Another new Amphenol development are the "Stub-E" Connectors, fulfilling environmental resistance requirements in aircraft and guided missiles.

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AIR TRANSPORT ADVISORY COUNCIL.

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

FROM DAN-AIR SERVICES, LTD., of 36-38 NEW BROAD ST., LONDON, E.C.2:—

APPLICATION NO. 3202/1 for an amendment to the terms of approval of the seasonal U.K. Internal Service which they are authorized to operate with Dakota and Bristol 170 aircraft, on the route Bristol-Cardiff (opt.)-Isle of Man, at a frequency of three return flights weekly from May 1 to October 31 each year, so as now to enable them to operate with Dakota, Bristol 170 and Dove aircraft, on the amended route Bristol and/or Cardiff-Isle of Man, at a frequency of seven return flights weekly from April 1 to October 31 each year.

FROM HUNTING-CLAN AIR TRANSPORT, LTD., OF LONDON AIRPORT, HOUNSLOW, MIDDX.:—

APPLICATION NO. 321/7 for an amendment to the terms of approval of the Colonial Coach Class Service which they are authorized to operate on the route London-Biarritz (tech.)-Gibraltar, with Dakota and Viking aircraft, at a frequency of 42 return flights per annum (with not more than four nor less than two return flights each 28 days), and which they have previously applied to operate also with Viscount aircraft, so as now to enable them to operate at a frequency of 52 return flights per annum.

FROM AIRLINES (JERSEY), LTD., OF STATES AIRPORT, JERSEY, C.I.:—

APPLICATION NO. 41/9 for an amendment to the terms of approval of the Normal Scheduled Service which they are authorized to operate on the route Manchester-Coventry-Bournemouth-Guernsey and/or Jersey-Dinard-Rennes-La Baule-Nantes (opt.) at a frequency of up to 12 return flights daily so as to enable them to omit the stop at Manchester at their discretion.

FROM BRITISH EUROPEAN AIRWAYS, OF BEALINE HOUSE, RUISLIP, MIDDX, for the following Helicopter Services initially with S.61 and Vertol aircraft and later also with Rotodyne aircraft, for the carriage of passengers, supplementary freight and mail, at a frequency in accordance with traffic demand on each service, for 10 years from date of approval:—

APPLICATION NO. 3339 between London and Paris.
APPLICATION NO. 3340 between London and Brussels.
APPLICATION NO. 3341 between London and Amsterdam.
APPLICATION NO. 3342 on the route London-Birmingham and/or Manchester.
APPLICATION NO. 3343 between Land's End and the Scilly Isles.

FROM EAGLE AIRWAYS, LTD., OF 40 EDGWARE ROAD, LONDON, W.2:—

APPLICATION NO. 3335 for a seasonal Normal Scheduled Service with Viking, Viscount and DC-6C aircraft, for the carriage of passengers, supplementary freight and mail on the route London-Lyons (opt. tech.)-Nice (opt. tech.)-Bastia (opt. tech.)-Palermo, at an initial frequency of three return flights weekly increasing later to one return flight daily, from May to October each year, for 10 years from date of approval.

Continued at top of next classified column

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Continued from previous classified column

FROM TRADAIR, LTD., OF SOUTHEND AIRPORT, ESSEX:—

APPLICATION NO. 3336 for an All Freight Service with Viking aircraft on the route Southend and/or Dusseldorf and/or Hanover and/or Berlin at an initial frequency of eight return flights monthly increasing later to 30 return flights monthly for seven years from date of approval.

FROM FISON-AIRWORK, LTD., OF BOURN, CAMBRIDGESHIRE:—

APPLICATION NO. 3337 for a Helicopter service initially with Westland S55 aircraft and later also with S58, S61, S62, Rotodyne and Vertol 107 aircraft, for the carriage of passengers, supplementary freight and mail, on the routes (a) London (Battersea) and/or London Airport and/or London (Gatwick) and/or Lydd and/or Southend, and (b) London (Battersea)-Birmingham at a frequency in accordance with traffic demand for 10 years from date of approval.

FROM INTER-CITY AIRWAYS, LTD., OF 87 REGENT STREET, LONDON, W.1:—

APPLICATION NO. 2406 (amended) for a Helicopter service with Westland S55 and Widgeon aircraft for the carriage of passengers, supplementary freight and mail on the routes (a) Portsmouth-Ryde, (b) Portsmouth-Ryde-Shanklin-Newport-Cowes-Southampton, and (c) Southampton-Cowes at a total frequency of 12 return flights daily for 10 years from May 15, 1960.

These applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on July 30, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Lean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. 515-1

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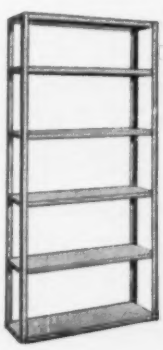

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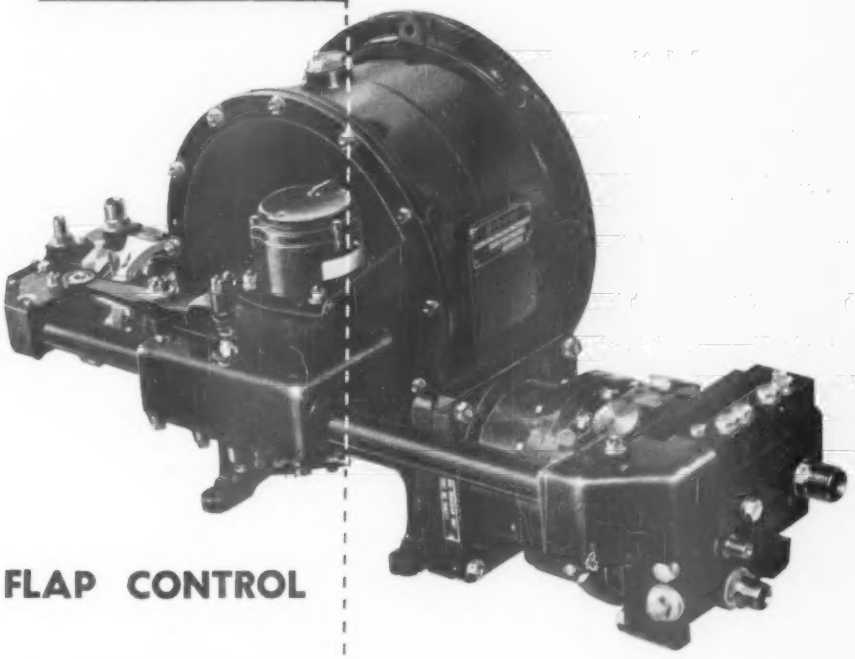

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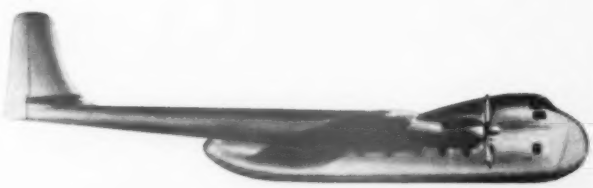

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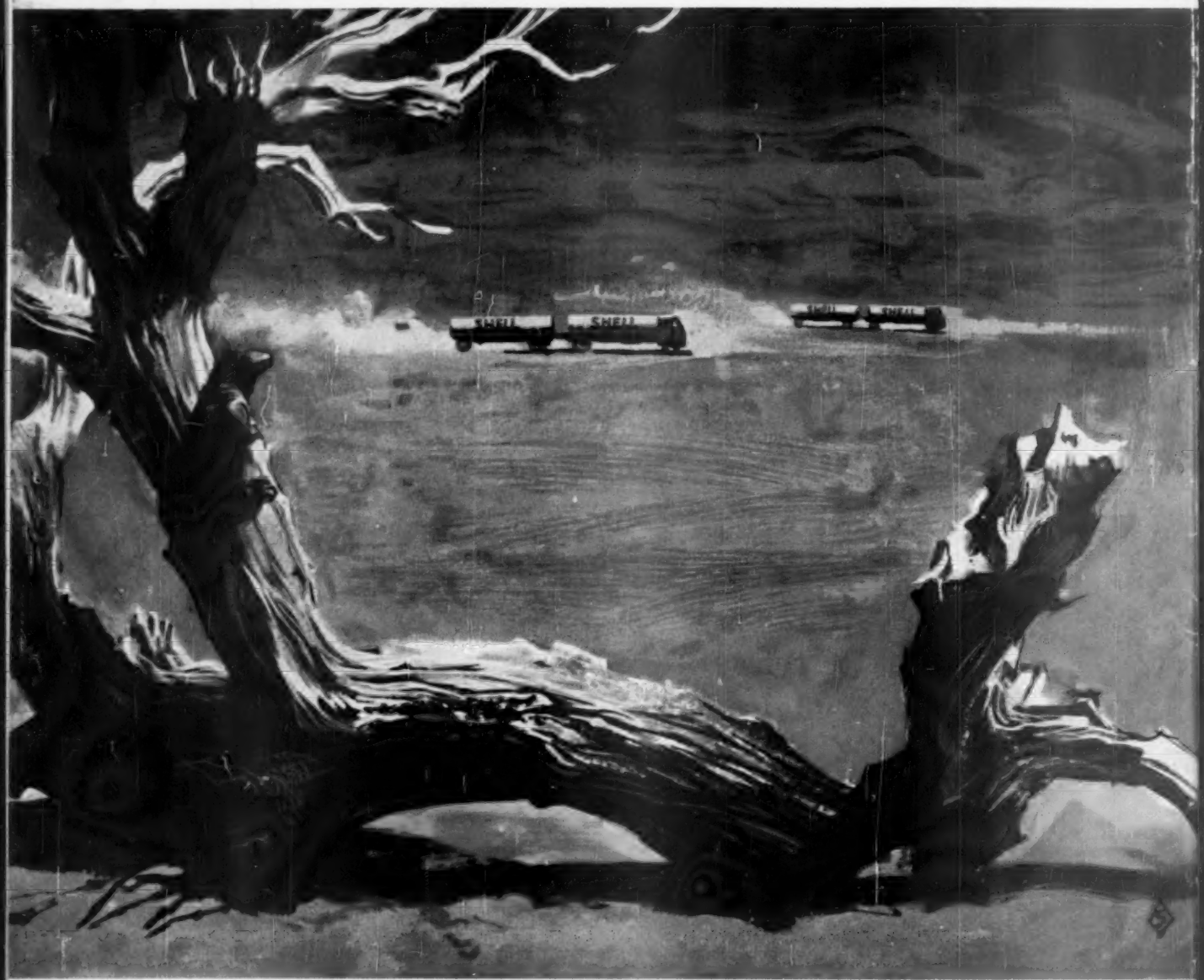

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